THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXVIII. No. 698.] LONDON, SEPTEMBER 26, 1876. [28TH YEAR.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL
COAL. Analysis—12,000 cubic feet of gas per ton of coal; 28-candle gas; coke 66·70 per cent.; volatile matters 33·30 per cent. Coke of good quality.
RAMSAY'S PATENT CONDENSED GARESFIELD COKE.
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GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
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SPECIAL GASOMETER PAINT
(Mixed ready for use).
These Paints are now used in 100 Country Gas-Works, and by all (but one) of the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.
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JOSEPH COWEN and CO.,
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Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
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AND
THE ALMA WORKS, WALSALL.
Established at the commencement of Gas Lighting.
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J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanized Tubes and High-Pressure Tubes, &c.
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And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
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RETORTS SET, AND GUARANTEED TO BURN OFF A CERTAIN AMOUNT OF COAL OR ELSE NO MONEY TAKEN FOR THE CONTRACT.
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Retort-Setters sent to all parts of Europe and America
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Warranted to Measure correctly & not to vary.

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EITHER BLACK, GALVANIZED, OR ENAMELLED HOT WATER TUBES AND FITTINGS,
CORE BARS, COILS, COCKS (IRON OR BRASS),
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TELEGRAPH TUBES OR POLES, &c., &c.

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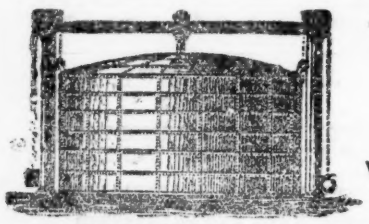

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REFERENCES TO UPWARDS OF 300 GAS-WORKS.

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WEST'S GAS IMPROVEMENT COMPANY,

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ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

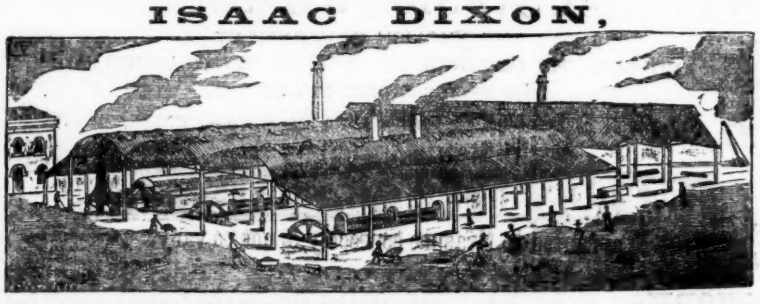
The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

ISAAC DIXON,

WINDSOR IRON-WORKS, LIVERPOOL.



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Manufacturer of SELF-SUPPORTING GALVANIZED CORRUGATED, CURVED, and every kind of IRON ROOFING, CHURCHES, SCHOOLS, SHEDS, and IRON BUILDINGS.

WROUGHT and CAST IRON GIRDERS, BRIDGES, TANKS, &c., and all kinds of WIRE WORK, FENCING, GATES, HURDLES, &c., for Home or Abroad.

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FOR GAS, STEAM, AND WATER;

GAS-FITTERS TOOLS, STEAM COCKS, AND ALL KINDS OF JOINTS.

HYDRAULIC TUBES, CORE BARS, TELEGRAPH POSTS, COILS, &c.

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GAS PURIFICATION & CHEMICAL Co., LIMITED.

(Successors to JOHN WILLIAM O'NEILL & CO.,)

Offices—PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.,

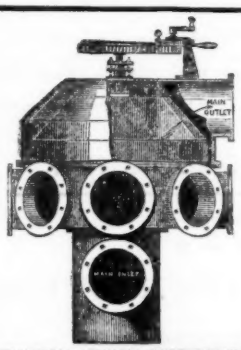
CONTRACTORS FOR GAS PURIFICATION BY OXIDE OF IRON.

The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

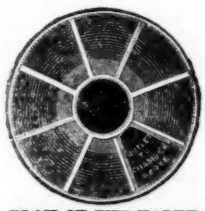
JOHN WILLIAM O'NEILL, SAMUEL H. JOHNSON, } Joint Managing Directors.

C. & W. WALKERS'

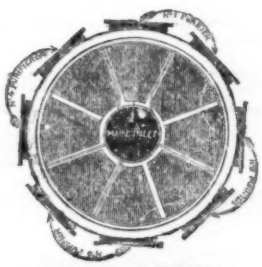
PATENT CENTRE-VALVES.



ELEVATION OF THE CENTRE-VALVE.



PLAN OF THE VALVE.



PLAN OF THE BODY.

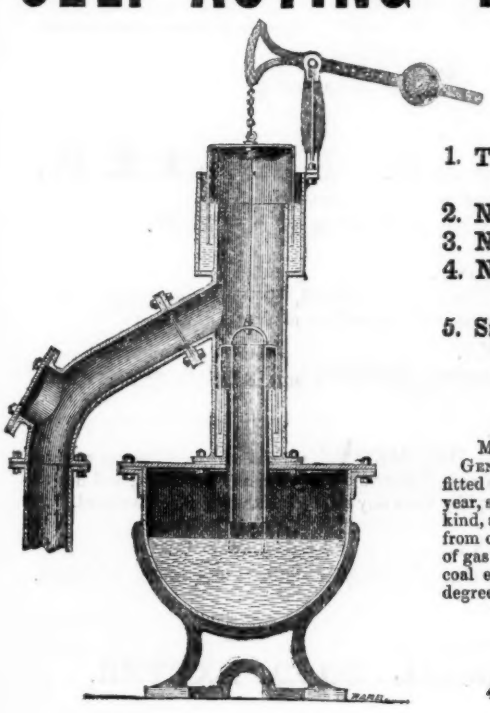
These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

MIDLAND IRON-WORKS. DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

SELF-ACTING REMOVABLE DIP-PIPE,

PATENTED BY

CHANDLER & STEVENSON.



ADVANTAGES.

1. There is no pressure on the Retorts.
2. No deposit of Carbon.
3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

TESTIMONIAL.

Tenby Gas-Works, March 29, 1876.

MESSRS. CHANDLER AND STEVENSON.

GENTLEMEN,—In reply to your inquiry, I have to say that all the retorts at these works are fitted with your Self-Acting Patent Dip-Pipes. They have been in use now for more than a year, some for more than two years. They have never required repair or attention of any kind, and work admirably. By the use of these removable dips the retorts are kept quite free from carbon, the charges burn off more quickly than before they were adopted, and the yield of gas is increased. We get regularly a weekly and monthly average yield of gas per ton of coal exceeding 10,400 feet of 14-candle gas, and I attribute this excellent result in no small degree to the use of these Self-Acting Removable Dip-Pipes.

I am, gentlemen, yours faithfully,

(Signed) EDMUND H. STEVENSON.

For terms of use and cost, apply to Mr. G. W. STEVENSON,

4, WESTMINSTER CHAMBERS, VICTORIA STREET, S.W.

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IMPERIAL METER COMPANY,

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KING'S ROAD, LONDON, N.W.,

OFFICE: 115, VICTORIA STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES,

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

Attention is called to their Dry Meters in Wood Cases, as used by the principal London Gas Companies. These Meters are especially suitable for seaport towns and for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

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GAS ENGINEERS,

WORKS: COMMERCIAL ROAD, EXETER,

INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

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NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.

An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

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GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

WILLIAM SUGG,

GAS ENGINEER,

VINCENT WORKS, VINCENT STREET,

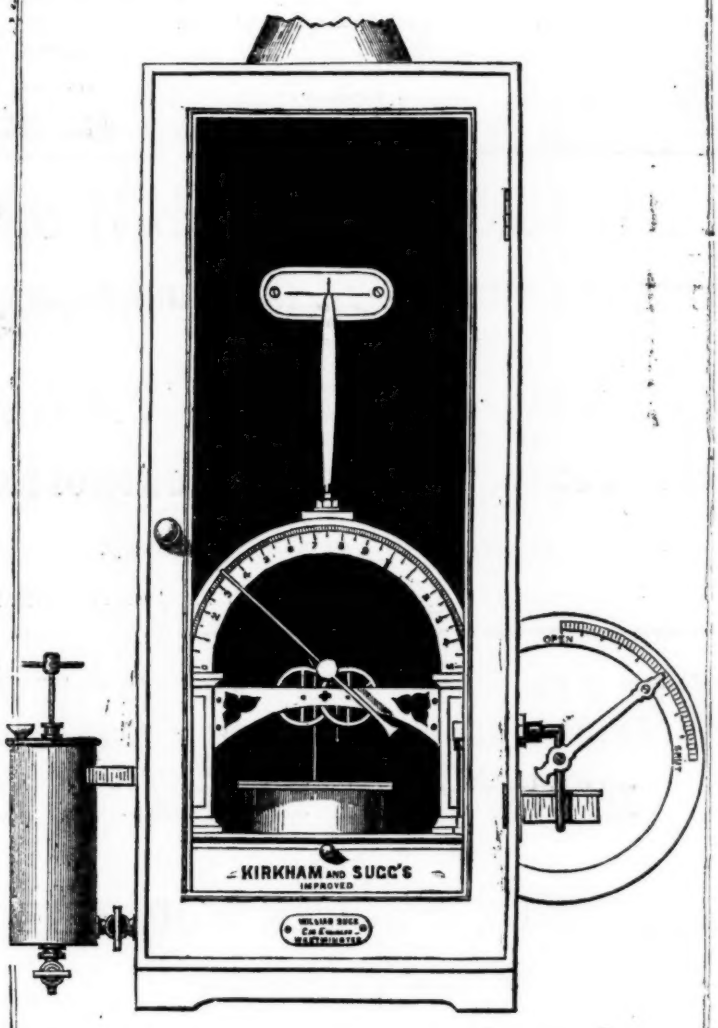
WESTMINSTER, S.W.

"EVANS"

Photometers,

which do not require a Dark Room, with every Fitting accurately made to Gauge, French Polished Bench and Drawers complete, as approved by the Gas Referees.

LOWE'S JET PHOTOMETER.



"LETHEBY"

Photometers,

with Fittings and Bench complete for Dark Room, as approved by the Gas Referees.

LOWE'S JET PHOTOMETER

(KIRKHAM AND SUGG'S IMPROVEMENTS),

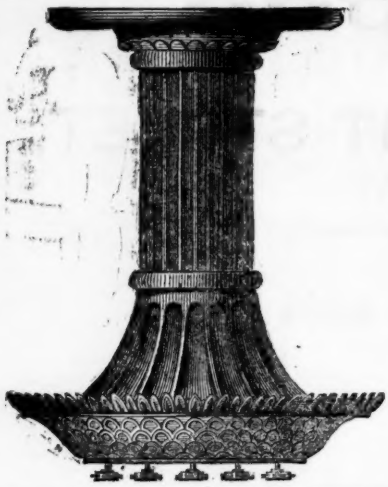
With new external Water-Line Regulator; Improved Micrometer, with Quadrant divided into 45 degrees; Valve, with *pro ratâ* opening; Improved Ventilator, Purple Glass Height of Flame Measurer; King's Gauge, working on Friction Rollers. In French Polished Pine Case. Diagram for ditto for finding the Illuminating Power in Candles.

PRICE £12 10s. COMPLETE.

Can also be had with additional Scale on Pressure Gauge, to show by inspection the Illuminating Power in Sperm Candles, at a slight extra cost.

NOTE.—When an order is given for a Jet Photometer with this latter addition, it will be necessary to state about the quality of Gas for which it will be used. The range in candles will not be more than three or four.

PRICE LISTS WILL BE FORWARDED POST FREE ON APPLICATION.



HENRY GREENE & SON,

GAS AND HOT WATER ENGINEERS,

155, CANNON STREET, E.C.

Manufactory: 19 & 20, NICHOLAS LANE, E.C.

SUN-BURNERS,

With Regulating Valves to obviate down draught.

MEDIÆVAL & OTHER GAS-FITTINGS

For Churches and Domestic Use.

ARCHITECTS' OWN DESIGNS WORKED OUT.

ESTIMATES FREE OF CHARGE.

THE TRADE SUPPLIED.

SOLE CONSIGNEES FOR BRÖNNER'S IMPROVEMENTS IN GAS LIGHTING.

IN THE MATTER OF

BRÖNNER'S GAS-BURNERS.

HENRY GREENE AND SON, 155, Cannon Street, London, Sole Agents for Great Britain, Ireland, and Colonies, of Brönner's Improvements in Gas Lighting, beg to inform the public that on the 13th of January, 1876, Julius Brönner obtained an injunction in the Court of Session, Scotland, against Donald M'Vean, Gas-Fitter, 14, Newton Street, Glasgow, prohibiting him from in any way advertising or offering for sale as Brönner's Burners, any Burner not manufactured by Julius Brönner, or from in any way inducing the public to believe that the said Donald M'Vean sells or keeps for sale Brönner's Burners, manufactured by Julius Brönner, while such is not the case.

Also that on the 9th of November, 1875, he obtained injunction in the same Court, and in the same terms, against R. M. Brechin and Co., 46, North Hanover Street, Edinburgh.

Also that on the 20th of April, 1875, in a suit in Chancery, before Vice-Chancellor Malins, number 1874, B 365, he obtained injunction against another defendant, in the same terms and on similar grounds.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD,

MANUFACTURERS OF

IMPROVED CENTRE-VALVES,

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

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IRONFOUNDERS,

WORKS:

SPRINGBANK FOUNDRY & NORTH WOODSIDE FOUNDRY,

GLASGOW;

BONLEA FOUNDRY, STOCKTON-ON-TEES,

Manufacturers of

CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.

„ 1½ to 7 „ STOCKTON.

A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 12s. 6d. from Glasgow.

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TANGYE BROTHERS AND HOLMAN,

LAURENCE POUNTNEY LANE, LONDON, E.C.,

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING

RETORT-LIDS,

WITH

HOLMAN'S NEW PATENT

BRACKETED CROSS-BARS,

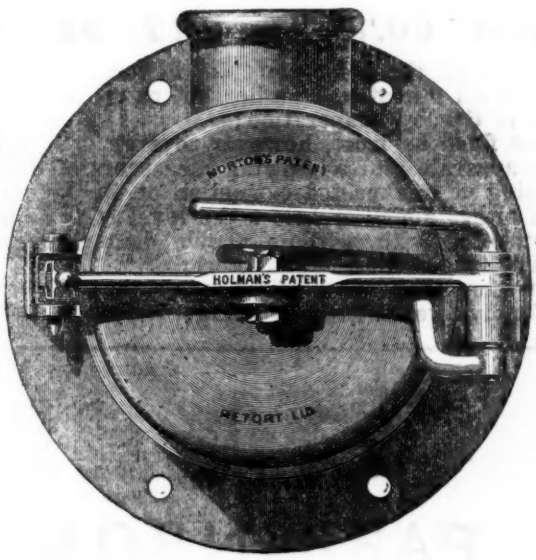
ANTI-FRICTION CATCHES, AND ECCENTRIC FASTENINGS.

NO LUTING.

NO DUPLICATE LIDS REQUIRED.

INSTANTANEOUS SEALING EFFECTED.

VERY DURABLE.



HOLMAN'S NEW SELF-SUSTAINING CROSS-BAR ENSURES FREEDOM OF JOINT, AND MAINTAINS PARALLEL POSITION OF THE LIDS.

By the employment of MORTON'S PATENT SELF-SEALING RETORT-LIDS, with HOLMAN'S PATENT ECCENTRIC FASTENINGS, the old-fashioned, cumbersome, and expensive method of sealing Retorts, by luting the lids with lime and other materials, is entirely dispensed with.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, over 20,000 being in use at various Gas-Works in London and the Provinces, among which may be mentioned:—

The Gaslight Co., Beckton (where nearly 4000 are in use).
" Gaslight Co., Bow Common.
" Gaslight Co., Silvertown.
" Gaslight Co., Lupus Street.
" London Gaslight Co.
" Independent do.
" Phœnix do.
" South Metropolitan Gaslight Co.
" Commercial do.
" Imperial do.
" West Ham Gas Co.
" Gas-Works, Barnet.

The Gas-Works, Royal Arsenal, Woolwich.
" do. Lower Sydenham.
" do. Brentford.
" Consumers Gas Co., Woolwich.
" Alliance and Dublin Gas-Works.
" Edinburgh do.
" Manchester Corporation do.
" Salford do. do.
" Rochdale do. do.
" Liverpool Gas-Works.
" Birmingham do.
" Birkenhead do.
" Nottingham do.

The Newcastle-on-Tyne Gas-Works.
" Lurgan do.
" Carmarthen Gas-Works.
" Merthyr Tydfil do.
" Windsor do.
" Leeds do.
" St. Albans do.
" Over Darwen do.
" Rotherham do.
" Aylesbury do.
" Bournemouth do.
" Ystrad do.
" Cardiff do.
" Rochester do.

The Keighley Gas-Works.
" Aberdare do.
" Ballymena do.
" Richmond do.
" Stalybridge do.
" Longton do.
" Exeter do.
" Ross do.
" Falmouth do.
" Barrow-in-Furness do.
" Belfast do.
" Wakefield do.
And other Provincial and Foreign Gas-Works.

IMPORTANT TESTIMONIAL.

The Gaslight and Coke Company (Commonly called the Chartered Gas Company), Beckton, North Woolwich, July 2, 1874.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them.

I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly,
(Signed) G. C. TREWBY.

London 1851. New York, 1853 Paris, 1855. London, 1862.

Dublin, 1865 Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

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PRELIMINARY ANNOUNCEMENT OF THE PUBLICATION IN MONTHLY PARTS OF

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

The Publisher of the JOURNAL OF GAS LIGHTING, *&c., has much pleasure in announcing that he has in course of preparation, and will shortly commence the issue, in monthly parts, of the "Treatise on the Manufacture and Distribution of Coal Gas."*

From the first appearance of these papers in the pages of the JOURNAL, *an earnest wish was expressed that, as soon as possible, they might be re-published in a separate form, and every subsequent week has brought communications to the Publisher, from various parts of the world, in which this desire has been repeated.*

The present advanced state of the work warrants the Publisher in notifying its speedy reproduction, in a serial form, with all the original, and many new, drawings and plans.

In this Edition of the "Treatise" every portion will be carefully revised, many parts will be entirely re-written, numerous additions will be made in each section, and some alterations will be carried out in the general arrangement.

The work will be printed in clear, bold type, on superior paper, and of a size which will admit of the introduction of numerous full-page and other engravings of works, plant, and apparatus.

The "Treatise" will be published monthly, in a coloured wrapper, at the price of 1*s. per number.*

Further particulars will be given in the next JOURNAL, *and in the meantime the Publisher cordially invites suggestions from Subscribers and others, with the view of making the new publication as complete as possible.*

11, *Bolt Court, Fleet Street, E.C., Sept.* 26, 1876.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, SEPTEMBER 26, 1876.

Circular to Gas Companies.

THE natural result has followed from the rise in price of the shares of the Chartered Company. A large number have been thrown upon the market, and, for the moment, the value has slightly declined. The present price, however, will yield but little over four per cent. An upward movement is also to be observed in the value of the Commercial Company's stock. This is not to be wondered at, for the company enjoy an exceptional, and, indeed, *unique* position. They have the initial or standard of 3s. 9d. per 1000 feet, and the sliding scale, with all the advantages it may bring to the shareholders; but they have escaped the infliction of auction clauses, with their manifest injustice to existing proprietors. It is not surprising, then, that the Commercial Company's stock commands a very high premium; for, as we have said before, stock or shares carrying the right to participate in subsequent issues, are of more intrinsic marketable value than stock or shares simply entitled to dividend. How far the sliding scale will convert gas property, which has hitherto been considered a most stable investment, into speculative property, like railway shares, we cannot say at the present time. We confess to a fear that greater fluctuations in price may result from the adoption of the sliding scale, and this we are bound to regard as a positive evil. With a maximum dividend of ten per cent. practically guaranteed, all went smoothly. Investors knew perfectly well what they were buying, and paid accordingly; but the uncertainties of to-day have evidently given rise to speculation, for we find Commercial stock touching 220. This price is, perhaps, fully justified, for the company must necessarily have a large balance of net revenue, much more than would suffice to pay ten per cent. It may, however, be considered premature to speculate on the condition of a balance-sheet before it is issued. But what gives the greatest interest to the forthcoming report of the Commercial Company, is the fact, that it will be the first from a company under a sliding-scale of dividend.

The accounts of the Phœnix Gas Company, for the past half year, with the report of the directors, have been issued, and we are happy to see a prosperous state of affairs revealed. A reduction of price of 3d. per 1000 feet, it will be remembered, was made at the beginning of the year, and, therefore, a large profit was not to be expected. As it turns out, however, there is, after paying full dividends, a balance of profit remaining to be carried forward. The report makes a brief allusion to the abortive parliamentary proceedings concerning the southern companies in the past session, and expresses a hope that agitation has now ceased, and that the company may pursue a peaceful career under the Act of 1860. We hope, and indeed believe, they may. The Metropolitan Board, and the Board of Trade, we think, will leave them alone, until they are compelled to go to Parliament for power to raise further capital, or are included in some scheme of amalgamation. Failing the latter, we hope the company will keep out of Parliament as long as possible, and show, what we believe to be the fact—that the Act of 1860, when properly applied, is, as the directors say, alike advantageous to shareholders and consumers. Supposing nothing to happen in the meantime, the Phœnix Company need not go to Parliament before a fair trial of the sliding scale has been made, and, perhaps, proved to be "a mockery, "a delusion, and a snare." Attention will then be drawn once again to the much-abused Act of 1860, which we have repeatedly said would, with some modifications, have served the purpose of consumers better than recent legislation. We are still, however, in hopes of seeing further combinations, which will place an united gas company in a more independent position. In the meantime, the directors of the Phœnix Company do well in developing their undertaking to the utmost extent. They supply gas of a quality very nearly equal to the requirements of the Referees and recent legislation, and they have exhibited a commendable desire to keep the price as low as is consistent with the legitimate rights of shareholders.

We are informed that the balance-sheet of the London Gas Company, which will shortly be issued, will, notwithstanding the fact that the price of gas was reduced in January last to 3s. 6d., show a balance of net revenue sufficient to pay full dividends on all classes of shares and stocks, and leave upwards of £7000 to be carried forward.

The Crystal Palace District Gas Company have had a pleasant half-yearly meeting. The proposal of the directors to convert

share capital into stock was confirmed, and it was duly explained that this stock could be disposed of in large or small amounts. This is, of course, perfectly true; but, practically, we rather think, stock is not much divided, and the sales of small portions are of rare occurrence. The increased allowance to the directors, all will admit, has been fairly earned. The company have prospered wonderfully under present management, and they have a great future before them.

The Harrow District Gas Company progress fairly. They, too, have a future, but the good time of full dividends will come but slowly. Five and a half per cent. is, however, not bad interest for a young company, and this it is proposed to pay for the past half year.

A correspondent, it will be seen, calls our attention to a section of the Gas-Works Clauses Act, 1847, which would appear to make it imperative on gas companies to pay up back dividends, before they form a reserve-fund. The reading adopted by our correspondent, in favour of which much might be urged, has never been accepted nor acted on by gas companies, the directors of which have always used their discretion as to the appropriation of surplus profits. In the case referred to last week, it was mentioned that the back dividends were, in part, paid out of a reserve-fund, which must have been formed while the dividends were in arrears. Further than this, we have heard of a company who set aside both a reserve and a contingency fund, and subsequently distributed both in payment of back dividends. In our opinion, the clause of the Act of 1847 is not so worded as to make the payments of back dividends imperative, before a reserve-fund is formed out of what we call surplus profits; but we are obliged to our correspondent for calling attention to the point, which will, no doubt, receive further notice.

A crusade against the Liverpool United Gas Company is now being organized, under the auspices of Dr. Cross, the chairman of the Special Gas Committee of the Corporation. In the Town Council, Dr. Cross does not find much support, so he is appealing to the ratepayers and consumers for funds to carry on the war. At a preliminary meeting, held last week, it appears that the only business transacted was the distribution of "collecting "books." A town's meeting is, however, to be held, at which Dr. Cross promises to give a full and complete exposure of the nefarious doings of the gas company. The agitation appears, to us, to be out of all proportion to the importance of the matter in dispute. An inquiry into the accounts at Quarter Sessions need not cost much money, and, after all, but little is to be gained by it. When, however, Dr. Cross makes his great speech, we shall better understand what his expectations are. By-and-by we shall have the defence of the company, and shall be able to judge how far those expectations are likely to be realized.

The rage for the acquisition of gas undertakings by local authorities, though somewhat abated, still prevails. The Local Board of Bangor have been smitten, and the gas company have expressed their willingness to part with the undertaking; but they ask £70,000 for it, which the Board think is too large a sum. At their last meeting, the Board passed a resolution, affirming the desirability of acquiring the works, and nominated a deputation to wait on the directors of the company, with the view of obtaining what the Board call "more equitable terms." If the terms asked are really excessive, no doubt some abatement will be made; but the directors must be the best judges of the value of their property, and would not, we think, be likely to ask for more than it is really worth.

The Corporation of Blackburn have resolved to apply to Parliament next session, for power to make a compulsory purchase of the gas company. We do not, at present, know how far they are likely to be opposed. If the process of absorption proceeds at its present rate, there will, in a few years, be but few gas companies left in the large towns in the North of England.

There are croakers everywhere, and it is no wonder some people in Warrington profess to believe that by the purchase of the gas-works, a heavy burden will be thrown upon the town. So far as we are able to see, there is no reason why the Corporation of Warrington should not do as well as other Corporations with recently purchased gas-works. They will not, at first, make much profit, and, consequently, they will not be able to reduce the price of gas; but if time be given them, and the undertaking be properly managed, it is certain, in the long run, to become profitable. At a meeting of property-owners, held last week, the report of which was received too late for our present issue, it was resolved, that, while approving of the acquisition of the works by the Town Council at a fair and reasonable price, it was gravely to be apprehended the terms already agreed upon with the company were not such as to serve the interests of the town. It was also resolved to request the Mayor to convene a town's meeting for the discussion of the question. At Wigan, we notice that a more hopeful spirit prevails, and it is anticipated that the purchase of the gas-works will prove of great advantage to the town.

The Local Board of Nantwich have also been smitten with a desire to acquire gas-works, and last week they convened a ratepayers meeting, with a view to obtain their support. There appear to be two difficulties in the way of this purchase. In the first place, the company (non-statutory) will not afford information as to their profits, and, further, will not say what sum of money they will require for the undertaking. Left thus in the dark, the ratepayers hesitate, and decline to entertain the idea of purchase until informed on the points above mentioned. The Gas Company, on the other hand, refuse to give the information until they have a binding agreement with the Board. On this we may remark, that the Board cannot be expected to buy a pig in a poke. The company should make their demand, and leave the Board to accept or refuse, as they think fit. The Board, it would appear, fostered a hope, that they might obtain a loan for the purchase, at a low rate of interest, from the Public Works Loan Commissioners. They have, however, been disabused. The Commissioners do not lend money for trading purposes. As the communication on the matter, from the Central authority to the Local Board of Nantwich, is of general interest, we subjoin it. Local Boards will gather, from Mr. Rotton's letter, the general terms on which the Local Government Board will consent to the purchase of gas undertakings:—

Local Government Board, Whitehall, Sept. 6, 1876.

Sir,—I am directed by the Local Government Board to acknowledge the receipt of your letter of the 29th ult., and to state that the Nantwich Local Board are correct in supposing that it will be necessary to obtain a Provisional Order to enable them to supply their district with gas; and the Board enclose for their information a copy of a Provisional Order which they issued on the subject on the 13th of April last, with reference to the district of Skelmersdale. With regard to any loan that might be raised to enable the Local Board to purchase existing gas-works, I am to state that the money could only be borrowed with the sanction of the Board and on the credit of the rates. The Board could not express any opinion as to what term they would allow for the repayment of the loan until the facts of the case were before them; but they may state that under ordinary circumstances they would not be prepared to allow a longer term than 30 years, unless the amount of the loan, together with the outstanding balances of existing debts, exceeds one year's rateable value of the district. I am to add, that the rate of interest to be paid on the loan must depend on the terms arranged between the Local Board and the lender of the money; but the Board may state that the Public Works Loan Commissioners would not be willing to advance a loan for gas purposes at a low rate of interest.
—I am, Sir, &c. J. F. Rotton.

The position taken up by the Ipswich Gas Company has, we rather think, damped the ardour of those who thought to make a rush at the company and carry all before them. An offer of annuities equal to maximum dividends may seem to some people munificent, but the consideration may be very inadequate. At Hereford, for example, it might have been thought that perpetual annuities equal to the dividends they had received would have fully compensated the shareholders; but, when the works came to be valued, it was found that every £100 of capital expended was worth £1000, which sum was cheerfully paid by the Corporation. We do not know how much has been expended out of revenue on capital account at Ipswich; but the refusal of the directors to entertain the proposal of the Corporation clearly indicates an opinion, that the value of the undertaking is not to be estimated on the basis of the capital raised.

The Town Council of the Royal Burgh of Dumfries are the first to adopt the Burghs Gas Supply (Scotland) Act, 1876, and will probably not be opposed by the gas company in their desire to acquire the undertaking. The Police Commissioners of the Bridge of Allan are about to follow suit.

Water and Sanitary Notes.

A somewhat bulky volume has been issued by the Local Government Board, in the shape of a report of their doings in 1875. We have before stated that the Board have become one of the most important departments of Home Government, second only, and nearly equal in importance to, the Home Office properly so called. The Board have at present assumed the functions of the old Poor Law Commissioners, the medical duties which were formerly exercised under the Privy Council, and are slowly taking over other functions which used to pertain to the Home Office and the Board of Trade. In the course of time we believe that all our departments of Home Government will require reconstruction, and one of the first to be submitted to the process will, we think, be the Local Government Board. But on this point we need not dilate. We are now only concerned with this report, with much of which, however, we have no call to deal. We leave the Poor Law statistics, interesting as they are, to other hands; and, for the present, we pass over the statistics relating to the indebtedness of local authorities, and local taxation. It is sufficient to say, that a little over 84 millions are now owing by local authorities—56 millions being secured by rates, 26

millions by tolls, dues, and rents, and nearly two millions by duties.

In another place, we extract the reports of Major F. Bolton, the Water Examiner for the Metropolis, and Mr. Stoneham, the Official Auditor of the Metropolitan Water Companies accounts. The former report details, with considerable minuteness, the efforts made by the companies to comply with the requirements of the Metropolis Water Act, 1871. It will be seen that every exertion is being made to improve the condition of the water supply, by the construction of large subsiding reservoirs and extensive filtering-beds. Further, that on the part of three at least, of the companies, great endeavours are made to extend a constant supply—endeavours which, we may say, receive anything but encouragement from the local authorities in the Metropolis. There are, it appears, now 670¼ miles of mains, constantly charged; and the East London Company now supply more than half the houses in their district on the constant system. Turning to another point, we notice, with great satisfaction, a quotation from the report of Captain Shaw, which shows that out of a total of 1529 fires, to which his officers were called in 1875, there was a deficiency of water in only four cases. The quantity of water used for extinguishing these 1529 fires appears to us exceedingly small, being only, according to Captain Shaw, 10⅓ millions of gallons, two-thirds of which quantity were taken from the companies mains. It should have been mentioned above, that, on the 670 miles of mains constantly charged under pressure, there are only 2622 hydrants, or but a little over three to a mile. Negotiations, we read, are still going on between the New River Company and the Corporation of the City of London respecting the fixing of hydrants in the City, in which the company can give a constant supply at very high pressure. If we remember rightly, these negotiations have been going on for a year or two, and the delay in coming to a decision is not creditable to the City. It is, we believe, a question of the cost of hydrants, the *desideratum* being a very cheap one.

We shall presently have the accounts of the water companies before us, so will now only quote from Major Bolton the capital actually expended by the eight water companies, which, it seems, at the end of last year amounted to £11,296,200. The Major speaks of the possibility of new sources of supply being required for the Metropolis. The cost of these may be guessed as follows:—To purchase the companies and their existing plant would require, say, 22 millions. Wells and other works around the Metropolis, in substitution or addition, would probably cost six or eight millions; and if a supply from Wales or the English lakes were decided on, the additional cost would probably be from 20 to 30 millions. These are the figures the Londoner will have to face when he thinks of changing his water supply.

As regards the quality of the water supplied at present, Major Bolton's utterances are rather vague. He begins by quoting Dr. Frankland, to the effect that, notwithstanding the greater care taken by the companies, the organic pollution in the water does not diminish. Then, in a paragraph closely following, he says, that, by the efforts of the companies, since 1871 the quality of the water has been considerably improved; and, in almost the next sentence, he says that all the exertions of the companies have been rendered abortive, by the increasing contamination of the rivers from which they mainly take their supply. We confess that we do not, and never did, quite understand Major Bolton. The report concludes with the innocent twaddle about dirty cisterns, and water-butts, and overflow-pipes carried into drains and water-closets, such as district medical officers put in their reports. The remedy for all these evils is, of course, a constant supply, and the abolition of all cisterns and butts. In the meantime, if people will be lazy and filthy, they must put up with the consequences. Happily, these do not appear to be dreadful. In spite of all the life-destroying influences which surround people in London, the week before last they only died at the rate of 16·7 per thousand annually. It is twenty years since so low a *weekly* death-rate was observed. At that date we really drank diluted sewage, and London proper was much more crowded than it is to-day. We have since spent six millions on sewerage works, and some millions for an improved water supply, and it would appear that, in a sanitary sense, we are just where we were twenty years ago. Let it not be supposed that we deprecate further improvements. We only wish to guard people against indulging hopes which will never be realized.

The report of Mr. Stoneham, the Official Auditor of the Water Companies, which has a particular interest, must stand over for notice until next week, with several other matters on which we have not space to comment.

Reductions in the Price of Gas.—The Corporation of Huddersfield have reduced the price of gas from 3s. 9d. to 3s. 4d. The Rhyl Gas Company intend to reduce their price to 5s. 2½d. on the 18th proximo.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CX.

Photometry.

Photometry may be defined as the comparative measurement of the intensities of the light emitted from different luminous sources. Light, like sound and radiant heat, varies in intensity inversely as the square of the distance; or, in other words, with direct variations of distance we have fourfold variations in intensity. This fundamental law, upon which the whole science and practice of photometry may be said to depend, is a direct sequence of the radiating and diverging nature of luminous rays, and of their rectilinear propagation. Fig. 1 will afford a good illustration of the law

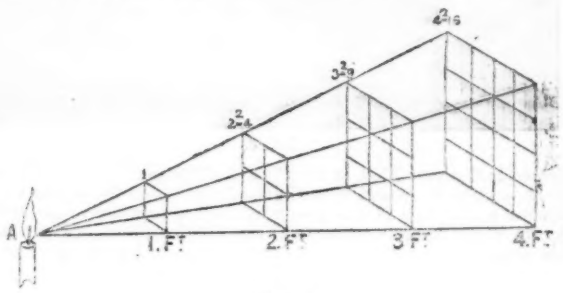


Fig. 1.

of inverse squares, where the diverging rays emitted by a source of light, which may, for the sake of demonstration, be considered as a single luminous point, fall on a given area, A, at a distance of—say 2 feet. At double the distance, or four feet, the light-rays cover four times the area, and the intensity of the light falling on the same space as before is, therefore, four times less. At three times the distance, or 6 feet, the same amount of light extends over nine times as much surface, and the intensity on the single given space is one-ninth; while with similar successive increments of distance, there are corresponding enlargements of area, and consequent diminutions in intensity.

The earliest attempts at practical light-measurement were made at the latter end of the last century by Count Rumford, and his method is now universally known as the "shadow test." The first apparatus used was extremely simple, the mode of conducting an experiment being simply to place a vertical stick at a short distance from some white surface, on to which its shadow would fall on the approach of any luminous body. The light whose intensity was to be examined was then brought near to the stick, and also a lighted candle used as a means of comparison. The two lights were so arranged as to produce two contiguous shadows of the stick, the comparative intensity of which varied with the position of each light and the degree of its initial luminosity. The relative position of the two lights was then altered, until the shadow cast by each appeared equal in intensity and the distance of each light from the stick measured, when the squares of the distances so found expressed the relative intensities. Supposing, for instance, that, with the original light at a distance of 9 feet, the candle had to be brought to within 3 feet of the stick, in order to produce a shadow of equal intensity to that of the light under examination. The relative intensities of the two lights would then be as the squares of the distances, or as 9 to 81, and the original light would therefore be equal to nine candles. A later improvement in the shadow test is represented at fig. 2, which shows

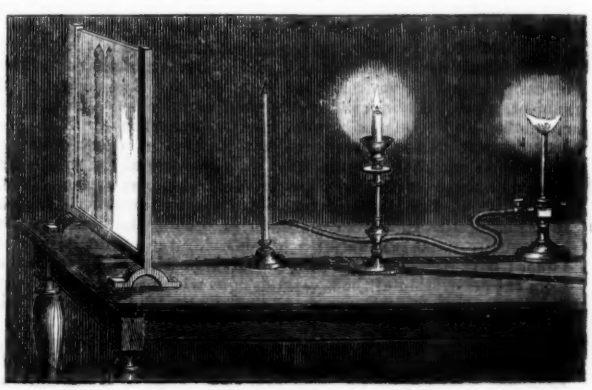


Fig. 2.

the form in which the apparatus was brought out by Count Rumford. In this case the shadows of the stick are cast on a ground-glass screen, and the comparison of the relative intensities can be effected with greater facility. Another form of the same apparatus differs in having the ground-glass plate divided in the centre by an opaque partition, two sticks being used, one on each side of the partition, the object presumably being to keep the light from the two sources more distinct. The shadows cast in this case, however, would be some distance apart—a condition not probably conducive to accurate

comparison. In any case, the judgment of different individuals as to the relative intensity of two shadows is found to differ; and the Rev. Mr. Bowditch goes to the extent of stating that, in those not possessing the requisite delicacy of perception, the results are "not worthy of credence." A modified form of the shadow test is shown in fig. 3, which represents the photometer of Bourgeur, which ap-

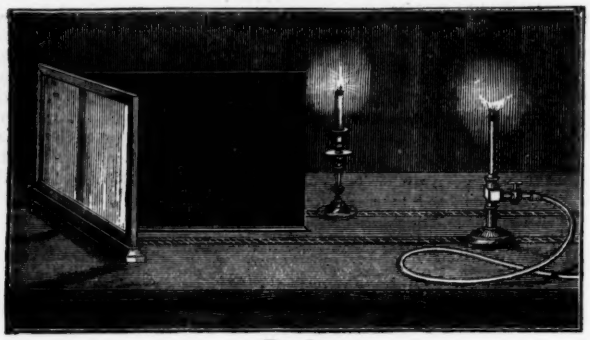


FIG. 3.

peared in the year 1760, in his "Traité d'Optique." In this instrument a sheet of ground or opal glass is divided in the centre by an opaque partition, and the two portions are separately illuminated by the lights under examination, the relative intensities of which are obtained by noting the distances requisite for the production of equal degrees of illumination of the two portions of the glass screen. A great improvement over the previous forms of photometer was made by the late Dr. Ritchie, of University College. This apparatus, represented in fix 4, consisted of a small rectangular box,

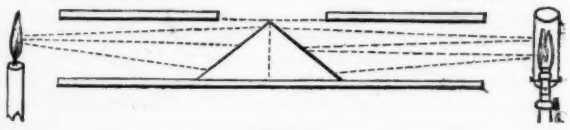


FIG. 4.

blackened on the inside, and having a width of about an inch and a half or two inches, with a length of about eight inches. It is open at both ends, and has also a central opening in the upper side. Immediately beneath this opening, and in the centre of the box, are arranged two plane mirrors, at an angle of 45° with the bottom of the box. The central opening is covered with a piece of thin paper. When the apparatus is placed between two sources of light, the light is reflected by the mirrors on to the paper screen, each half of which becomes illuminated to a degree proportionate to the source of light, and by shifting the apparatus towards the one light or the other, an equal adjustment may be made, and the relative distances then taken. This form of photometer has been used by several observers, who testify to its efficiency. A less desirable form of this instrument had simply two white paper surfaces in the place of the plane mirrors, the paper screen being absent, and the observations made by looking at the two surfaces direct.

(To be continued.)

MANCHESTER CORPORATION GAS-WORKS.

DESIGNS FOR ADDITIONAL WORKS.

The proposed additional gas-works for the city of Manchester may be regarded as the most important scheme that has ever been submitted to public competition, and we are quite sure those interested practically in works of this nature will expect that we should give to the designs submitted a careful and painstaking examination.

The corporation have purchased a site on the Bradford Road, in what may be looked upon as an eastern suburb of Manchester, and corresponding in many respects with many of the open spaces that are to be found adjoining the several railways in the eastern district of London between Old Ford and Blackwall.

The first instructions issued to the competitors were precise and distinct, respecting the provision to be made for the production of gas. It was required that "the intended works should be divided into four portions, each complete within itself, and capable of being erected separately, the aggregate of which must be capable of producing, purifying, measuring, storing, and delivering into mains immediately outside the works, not less than 20 million cubic feet of gas in 24 hours."

Storeage under cover for 100,000 tons of cannel, also storeage for coke, oxide, and gas tar and ammoniacal liquor, were, of course, required in addition, and provision was also to be made for getting the coke for sale on to the railway.

Subsequent instructions were issued as follows:—"Some doubt having been expressed as to the capacity of the plot of land to contain works" as above mentioned, the committee have decided to "increase the area of the site" in a manner mentioned, and there was the important addition, that "the committee further leave you at liberty to design works of the greatest capacity which you may consider the site capable of containing, dividing them into three or four sections," and also there were others reducing the proportion of store of cannel and gasholding capacity.

The Gas Committee, in order to arrive at a conclusion, called in the assistance of three eminent engineers—Messrs. Hawksley and Livesey, of London, and Mr. King, of Liverpool.

The instructions set forth give the widest possible margin to those who entered into this competition, and as a result we have a number of designs showing various amounts of practical knowledge on the subject, great skill in combination and arrangement, and a highly creditable display of the powers of the draughtsman. Some have attempted to obtain a large make, regardless of every other consideration; and others, again, have been as painstaking to construct works for the manufacture of gas at a low cost of production. Some, the larger majority, have well considered the great question of economy in bringing the cannel to the retorts; others, the lesser number, the equally important question of removing the residuals, coke and liquor; but all these points will, we think, be gleaned by our readers from the description of the several designs which we propose to give.

In order that this report may be well understood, we give a plan of the site.

The branch line of railway which forms one of the boundaries, is here on a curve, and has a falling gradient, from the bridge over the Bradford Road to that over the canal and river, of about one in a hundred.

The river Medlock, whatever may have been its condition before it received the refuse from various manufactories and works, is as polluted a stream as can well be imagined, and must be regarded as little more than an uncovered sewer of large dimensions. This river is subject to floods; and rectifying its course, by building a retaining-wall, was one of the works undertaken by the corporation, but which had not to be taken into consideration by the competitors.

The river Medlock forms not only the southern boundary, but also the greater part of the eastern boundary, the retaining-wall just alluded to being the limit of the site.

At the point where the railway crosses the river, it also crosses the Ashton Canal, so that we have here one of those singular combinations of a canal aqueduct crossing a stream, and a railway viaduct crossing both.

Adjoining the towing-path of this canal, the gas-works have a considerable frontage, and an area of about two acres, access being obtained to this part of the site, which is on the west side of the branch railway, under one of its arches.

The plan furnished by the Gas Committee shows a siding formed on arches, for the use of the gas-works, and forming cannel stores under, but this had not to be included in the cost of the gas-works.

Omitting the area occupied by this siding, and also that of the wharf, if we may so call it, by the side of the canal, the site on which the gas-works had to be arranged has a length of about 1600 feet, by a width of about 700, and an area of about 21 acres.

The surface of the site is now very uneven; the lower portion, in time of floods, is under water, and it was suggested, by the instructions, that this area should be raised so as to be 24 feet above the ordinary level of the water of the Medlock, or nearly level with the towing-path of the canal. The site thus raised will still be 19 feet below the rails of the branch railway at the canal end, and 33 feet below the rails at the opposite end, next the Bradford Road.

"*Hydrocarbon.*"

The first premium of £500 has been awarded to the design with this motto, and to it we necessarily give our first attention. It is by Messrs. Mangnall and Littlewoods, architects, of Manchester, who, we understand, have already executed other works of this description in that city. It is extremely well illustrated by seven drawings, including a coloured bird's-eye view of the whole establishment.

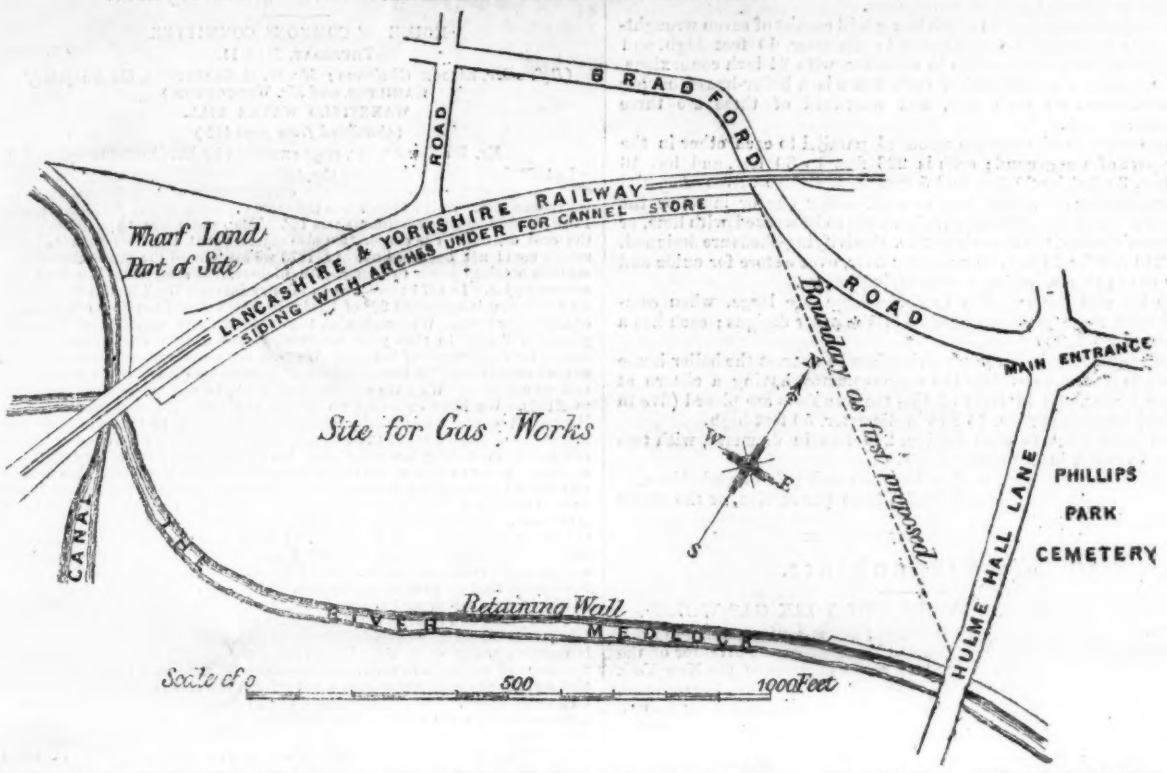
Cannel stores are formed adjoining the railway, filling the space between it and a chord line between the ends of the arches built or building.

The retort-houses, eight in number, abut upon these cannel stores, and are at right angles to them. They are arranged in pairs, each being 365 feet long by 70 feet in width, each pair having between them a cannel store 50 feet wide, the capacity of which is stated to be 12,500 tons. From the railway siding the cannel can be brought direct to these stores in the trucks by means of turntables, for which purpose there is a double line of rails on each side of each house, and as the railway has a falling gradient, these houses are built one a little lower than the other. Between each pair of houses are coke yards 85 feet wide.

These retort-houses are not stage houses, and in the printed description, which accompanies the design, they are stated to be "erected on columns, and would be open on one side." The roof would be constructed of wrought and cast iron, the roof principals being semicircular, formed of wrought-iron lattice work, each principal fixed 17 feet apart, with cast-iron purlins and intermediate rafters to carry the wrought-iron laths, to which the slates would be secured with lead holdfasts, the whole being fire-proof. The width of the house is of such dimensions as will allow the retorts being fired and drawn by machinery, the house being arranged so as to be open at each end for the machinery to work past the end retorts, and for easy communication with the cannel stores at one side and one end. A tramway would be formed along the side of each retort-house, with a double line of rails, for the convenience of removing coke from the yards below, and would be constructed with cast-iron columns and girders, and covered with planking between the rails, and protected with open iron balcony railing.

Each house is to have 38 ovens of seven retorts, 20 feet long, and the make is taken to be 5,054,000 feet in 24 hours, or about 5000 feet per mouthpiece, with due allowance for some being out of work. We

MANCHESTER CORPORATION GAS-WORKS.



cannot avoid the remark that 365 feet is a very short length for 38 benches, particularly when, as our notes indicate, there are three chimney-shafts to each house, allowing gangways from side to side.

Over the centre portion of each cannel shed, on columns above the rails that carry the trucks, it is proposed to place a condenser or cooler belonging to each pair of houses. This is 325 feet long by 22 feet wide and 5 feet deep, and is raised 45 feet above the surface of the floor.

This is an arrangement of such an unusual character that we call special attention to it. A condenser being placed so high and out of reach we think can only be regarded as a bold experiment to economize space—rather hazardous for works of this magnitude.

A road, 45 feet wide, is continued from one end of the works to the other, from which the yards and these retort-houses can be approached. On the opposite side of it will be placed two sets of buildings, similar in arrangement, consisting in each case of an exhauster-house, 60 feet by 60 feet, to do the work of two sections, each having three of Beale's exhausters, to pass 120,000 feet per hour, one being in reserve. There will be six scrubbers to each, 12 feet in diameter, 40 feet high, those patented by Mr. William Mann being recommended. Sixteen purifiers are provided to each section, each 24 feet by 24 feet, the building being 215 feet long by 60 feet wide, the covers to be raised by hydraulic power. An area for revivifying is behind each. The governor and meter house is near the entrance, in four sections, each 45 feet square, to be one building when the works are completed.

Fourteen gasholders are shown, of various diameters, from 150 feet to 100 feet, each having three lifts of 30 feet. Eleven of these are placed behind the purifying-houses, between them and the Medlock, and three on the canal wharf. The total capacity of these is stated to be 19,800,000 cubic feet, giving an average of as nearly as possible 5 million cubic feet to each section.

Near the gateway are the offices, and a lodge for gatekeeper, a store-room, 70 feet by 30 feet, mechanics shop, stokers day-room, and a canteen. There is also an experimental gas-testing apparatus, with small holder, 15 feet in diameter, with three retorts and two sets of small purifiers, near the gatekeeper's lodge. Tramways are proposed along the wharf and in the main avenue, for moving material. Two tar-wells, 50 feet in diameter, are shown to each section.

The cost of buildings is stated at £250,000, and of the machinery, retort work, gasholders, &c., £500,000; making a total of £750,000.

The general arrangement of this design, in utilizing to the utmost the limited area of the site, is admirable, and we consider we shall only be meeting the wishes of our readers by giving, in a future issue, a plan of the whole.

"*Thorough.*"

The second premium has been awarded to this design, which is by Mr. G. W. Stevenson, of Westminster, and Mr. H. J. Paull, of Manchester.

The report that accompanies it alludes to the land being insufficient for works of reasonable construction, capable of producing and storing 20 million cubic feet of gas in 24 hours. The authors, therefore, submitted two schemes, the one (A) for making 20,800,000, and storing 8,600,000, and the other (B) for producing and storing 15,600,000.

They state also that it was not impossible to produce works to make and store what was required, but it could only be at a heavy outlay and increased working expenses.

The key-note of this design is reported to be the "connected, or through treatment of the retort-houses."

The cannel stores are ample, and are, as in the last-mentioned plan, by the side of the railway, only wider. A road separates them from a series of buildings extending parallel with the railway siding, as follows:—

In design A there are four retort-houses, having behind them four blocks of buildings in connexion with these retort-houses.

In design B there are three retort-houses and three blocks, but these last are placed between the retort-houses, thus giving extra space for additional gasholders.

The retort-houses are placed parallel with the cannel stores, and are 275 feet long by 150 feet in width. They are double, and each has four chimney-shafts drawing from six ovens, one on each side, each of which has nine retorts. We have thus 864 mouthpieces, the make from which is assumed to be 4,600,000 feet, or, allowing no deduction, upwards of 5300 per mouthpiece.

The buildings attached are, in each case, lavatory, mess-room, smith's shop, boiler-house, and an enclosure for scrubbers.

Tramways are provided from the coal stores to the houses; but, as we read this plan, every hundredweight of cannel is first dropped from the trucks into the stores, and lifted again for use. A coke floor is proposed below the normal level of the ground, and "to remove the coke from the cellars an endless wire band, 24 inches wide, driven at a proper speed and constantly revolving, which shall receive the coke as drawn, and carry it to the south-west angle of the land for delivery into tram trucks or by rail."

Horizontal condensers are proposed, of six 12-inch mains. Six scrubbers to each section, 12 feet diameter, 55 feet high, concerning which it is stated five would suffice, but one is proposed as a check, with larger connexions.

Three sets of purifiers of four, each 40 feet square, 6 feet deep, with dry valves, the gas divided into three streams, but arranged so that it could be confined to two.

For economy of space there is an upper floor for storeage and revivifying oxide, to be raised by buckets and endless bands, and redelivered by funnels and worm feeders.

Design A has two gasholders 230 feet in diameter, with three 36-feet lifts.

Design B has six holders, 180 feet in diameter, with three lifts of 36 feet.

The cost of plan A is estimated at £586,000, and plan B at £615,000.

"*Omne Trinum Perfectum.*"

The third premium has been awarded to this design by Messrs. Newton, Chambers, and Co., of Sheffield.

This is arranged in three sections, and consists of three retort-houses parallel to each other, not placed as in the previous designs but at right angles to Hulme Hall Lane. They are 628 feet by 90 feet, with a section similar to the houses at Beckton. The supply is intended to be direct from the railway, rails being laid on each side of each house. Each house has two chimney-stacks, with 16 arches on each side, and each has eight 20-feet retorts, 18 inches in diameter. The dip-pipes are to have Hawkins's patent cups. The make here is

given at 5,632,000 feet for each section, which, as there are 1024 mouthpieces, gives 5500 per mouthpiece.

The annular condensers to each house will consist of seven wrought-iron outer cylinders, 3 feet 6 inches in diameter, 40 feet high, and inner cylinders 2 feet 6 inches in diameter, with 24-inch connexions.

Attached to the west end of each house is a boiler-house, having the condensers on each side, and westward of these are three exhauster-houses.

Three purifying-houses are arranged parallel to each other in the other part of the ground; each is 226 feet by 80 feet, and has 16 purifiers, 30 feet by 20 feet, and 5 feet deep. Centre-valves of special construction for eight purifiers, to work either one or more, or the whole 16. The first, two sets, or eight, are to be worked with lime, or Patterson's patent, the rest with oxide. Revivifying-sheds are designed, each 240 feet by 58 feet, on an upper floor, over a store for oxide and other rough stores, behind the purifying-houses.

The tar and liquor tanks in this design are large, when compared with those provided in some of the other designs; each has a capacity for 100,000 gallons.

At the end of each of the purifying-houses nearest the boiler-house a tower is placed, to contain the various pumps, having a cistern at the top for tar, and in front of this the scrubbers are placed (five in number) for each section, 15 feet in diameter, 50 feet high.

Two gasholders to each section, 200 feet in diameter, with two lifts of 42 feet 6 inches each.

A meter-house to each section, between each pair of gasholders.

The estimated cost is stated at £276,000 per section, or the whole at £830,000.

Correspondence.

RETORT-SETTINGS AT THE NEW YORK GAS-WORKS.

SIR,—In my communication respecting retort-settings, &c., published in your JOURNAL of Aug. 8, I spoke of Mr. Stanley, the inventor of the particular hydraulic-main referred to, as the engineer of the New York Gas Company. This is incorrect. Mr. Charles C. Mowton is the engineer, and has been for many years—in fact, ever since the death of his father.

Sept. 19, 1876. W. MANN.

BACK DIVIDENDS *VERSUS* RESERVE-FUND.

SIR,—In your "Circular to Gas Companies," of the 19th inst., I note the following remarks:—"The *policy* of paying back dividends must be decided, having regard to special circumstances." You "believe that . . . it will be found more advantageous to shareholders, and a better security for the value of gas property, to have a strong reserve-fund, than to expend surplus profits in making up past deficiencies."

I will presume that most companies who are in a position to pay back dividends, are under the provisions of the Gas-Works Clauses Act, 1847; and, if I correctly read that Act, it is *imperative* on such companies to pay *all back dividends* before they have the *power* to make *a reserve-fund*, unless they have exceptional provisions in their special Act.

I annex copy of such portions of the 31st clause of that Act as bear upon the question, to support my position; and, believing this to be a very important subject for many companies, I shall be pleased to have the opinion of my *confrères* on the point raised.

James Street, Harrogate, Sept. 20, 1876. P. H. WILKINSON.

Gas-Works Clauses Act, 1847, *Clause* 31.

If the clear profits of the undertaking in any year amount to a larger sum than is sufficient, after making up the deficiency of any previous year as aforesaid, to make a dividend at the prescribed rate, the excess beyond the sum necessary for such purpose shall from time to time be invested in Government or other securities; . . . which sum shall form a reserved fund to answer any deficiency which may at any time happen in the amount of divisible profits, or to meet any extraordinary claim or demand which may at any time arise against the undertakers.

COST OF PURIFICATION.

SIR,—In reply to "Query's" letter, allow me to point out a few possible causes of the difference in the quantity of lime used, per ton of coal carbonized, by companies A and B.

1. The quantity of sulphur in different kinds of coal varies very much; the amount, according to Mr. Lewis Thompson's analyses of coals, ranging from one-half per cent. to four per cent.; consequently the quantity of sulphur impurity to be removed also varies very much.

2. The heats and the length of distillation affect the quantity of impurity; the more intense the heat, and the longer it is continued, the greater the quantity of sulphuretted hydrogen produced.

3. Effective condensation, and the use of scrubbers and purifiers, will remove a large amount of sulphuretted hydrogen and other impurities; and being removed by these means, will not require to be removed in the "purifiers."

4. The quality of the lime, and the mode in which it is prepared for use, will make some difference in the quantity used.

5. Small purifiers relatively to the quantity of gas made, the gas passing rapidly through them, on account of their being small, and defective arrangements for changing them—the lime being removed before it is worked out—are other elements which may be taken into account.

6. Are A and B sending out gas equally free from impurity?

The comparison of the cost in money to C, with the quantity used in tons by A and B, does not appear to be of much value, because it may happen that the net cost to A and B, after deducting the receipts for foul lime sold, may be less than the cost to C. I can buy lime at a low price, use it for purifying, whereby its weight is about doubled, and then sell it for more than it originally cost. H. T.

ASSAULTING A LAMPLIGHTER.—At the Bristol Police Court, on Thursday last, a young man, named William Baker, was charged with assaulting a lamplighter in the employ of the Bristol United Gas Company, while in the discharge of his duties. The magistrates, regarding the case as a very grave one, sentenced the defendant to two months hard labour, without the option of paying a fine.

Parliamentary Intelligence.

HOUSE OF COMMONS COMMITTEE.

THURSDAY, MAY 11.

(*Before Mr.* ELLICE, *Chairman; Mr.* W. H. GLADSTONE, *the Marquis of* HAMILTON, *and Mr.* WROUGHTON.)

WAKEFIELD WATER BILL.

(*Continued from page* 412.)

Mr. *William Statter*, cross-examined by Mr. MICHAEL.

In 1863 the company promoted the Ardsley scheme, which was given up in consequence of the opposition of the corporation, who complained that the water was hard. In 1872 there was the same objection to the Parkhill scheme. I believe the temporary hardness was 18°. That water was to be taken from the coal district. The corporation also objected that the continuance of the supply could not be relied on. In 1873 we introduced the same scheme, and we then obtained power to construct a high-service reservoir. We have not constructed it. In 1874 there was an inquiry into the Heck Snaith water; but we found that it contained 22° of hardness, which would not do for Wakefield, or any other town. We found, also, that the hardness consisted of lime and plaster of Paris. In that year we obtained power from Parliament to raise money for the purpose of borings. We have not made any ourselves, but have availed ourselves of the investigations of persons who have made borings by sinking collieries. We have expended at Heck, in making shafts, from £800 to £1000. We have expended no money elsewhere for that purpose. The Heck shaft was sunk in a totally different stratification to that which we now propose to go to. We are in the coal measures, on which we have not expended any money in making investigations. We depend upon finding here the same supply of water as that which is now pumped up from the Wath. We believe this water is suitable for manufacturing purposes. I do not know what is the general opinion of the manufacturers on the subject. In Wakefield they think it suitable. The textile manufacturers of Wakefield now use about 1-20th of the whole consumption of the town. I have never heard the brewers make any objection to our present supply. I cannot say whether the character of our proposed supply is similar. It is important to every one using boilers to have water that does not encrust them. The boilers we have put up at the Wath pit, from which we have been taking water, have been in operation two or three years, and there is not the slightest particle of incrustation upon them. I believe it is generally conceded that soft water, for manufacturing purposes, is, *cæteris paribus*, desirable. With regard to health, I think 4 or 5 grains of carbonate of magnesia in water has very little effect, though I can understand that a change to such water from a water free from mineral salts might be productive of illness. I should consider 40 or 50 grains of carbonate of magnesia a large quantity; but to get a teaspoonful of that in the intestines, a person would require to drink 20 gallons of the water. The quantity of mineral salts in this water would produce no result at all. A hardness of 10° or 11° could not be objected to.

Mr. *Thomas Woodhouse*, examined by Mr. BALFOUR BROWNE.

I am a civil and mining engineer, practising in London and Derby, and have had 40 years experience in all the mining districts in the United Kingdom. I am well acquainted with the South Yorkshire coal-fields, and with this district in particular. By "this district" I mean the Dearne Valley, all the way from Leeds down to Rotherham, more than in the West of Yorkshire. I have made a visit to examine the place where they propose to erect the pumping-station. The chief fault in this valley runs from east to west. My experience of the valley convinces me that there is an abundance of water in this rock. I am quite positive of it. So much so that there will be abundance for Wakefield for many years to come. I have examined the plans that are proposed, and I consider the site of the pumping-station well selected, because it is central—it is in a good situation for access from the surface, and so on. With regard to the rock itself, I do not think it is very material whether the pumping-reservoir, or well I may call it, is made there, or whether it is made a little further off, for the rock runs under the whole district. I suppose it was done more with the view of acquiring the land, and an easy access. The great throw acts underground, as a dam does above ground, and the strata dip towards this great throw, which will form a natural dam across the whole, and the water will be kept from flowing away to the lower part of the mine, so that the nearer this pumping-station is, taking into account the dip, the more water they will have. I am informed the Wath Main sinking produces 3,500,000 gallons per day. [Witness handed in a table showing the results of pumping at collieries near Darfield, south of the Great Fault, from which it appeared that the maximum quantity pumped from the Darley Main was 4,200,000; Oaks, New, 2,300,000: Mitchell's Main, 3,500,000; Manners's, New, 4,924,000; and Wath Main, 3,500,000 gallons per day. The quantity obtained north of the Great Fault, on the Houghton Main, was 2,200,000 gallons.] I do not apprehend any danger from the subsidence of the strata under the Oaks Rock from the working of coal underneath. I have not the slightest doubt that the supply would be ample and permanent.

The CHAIRMAN: I think Mr. Woodhouse's evidence goes to the effect that he has no doubt of the sufficiency and permanency of the supply.

Mr. BALFOUR BROWNE: And he has given you, as far as he can, his reasons for thinking so.

Witness was cross-examined at length with reference to the geological character of the district, and the probable effect of the working out of the collieries there, in producing subsidence and fracture of the water-bearing strata, and consequent escape of the water. He expressed a strong opinion that no such effect would ensue.

Dr. *Edward Frankland*, examined by Mr. VENABLES.

I am a Fellow of the Royal Society, and Professor of Chemistry in the Royal School of Mines; and I have for more than six years been one of the Royal Commissioners to inquire into the pollution of rivers and the water supply of Great Britain. My colleagues are Sir William Denison and Mr. John Chalmers Morton. We have made very extensive researches, and have spared no pains in investigating the water supply of all districts. The conclusions at which we have arrived are summed up in our sixth report, which was presented to Parliament in 1874. Our third report contained the result of our investigations into the state of the Aire and Calder basins. The commissioners visited Wakefield, and inspected the Calder in 1868 and 1869. On the last occasion I think I inspected the water-works of this company. I have investigated a great many water supplies, and comparing them with each other, I should put Wakefield at the very bottom of the list as regards pollution and as regards the objectionable quality of the water for domestic purposes. I do not remember any public water supply that is so bad as this. In our report we state that there was a great deal of refuse, both from Wakefield itself and from places above, poured into the river, and we add: "Our own analyses and observations entirely confirm this statement, incredible as it may appear, and although the water is filtered by a patent process, it is difficult to conceive anything more disgusting and dangerous to health than a populous community thus systematically, and by an elaborate and costly arrangement of reservoirs, pumps, filters, and distributory apparatus, drinking its own filtered sewage taken from a stream in a black and putrescent condition. We have analyzed two samples of this water supply, taken at an interval of a year. Although the water,

owing in part to putrescent fermentation and subsidence, and in part to filtration, was chemically less contaminated than might be expected, yet, on both occasions, it contained a large proportion of nitrogenous organic matter." That report was founded upon analyses made in the years 1868-9. I may say that in June, 1874, I again examined the water, and it was in quite as bad a condition then. There is no doubt that it is a water which ought not to be supplied. I have quite recently examined another sample of this water, which is of a considerably better quality from a chemical point of view; but still, looking at its origin, it is quite as objectionable for domestic supply as the former water. The chemical changes depend a great deal upon the filtration by Dr. Spencer's process, which I have seen in operation on the works. There was a plan two years ago to get water from the Don basin. The quality of that water is very good, but for dietetic and general household purposes I should prefer the water which it is now proposed to supply to Wakefield, rather than the water the supply of which was contemplated two years ago. I was comparing Wath Main water with the water which would be obtained from the Don, according to the previous bill, which was thrown out; and speaking generally, I should say that of all sources of water for domestic supply, springs and deep wells are the two sources to be preferred to water even from mountain sources; because those waters contain, as a rule, a much smaller per centage of organic matter than the waters from gathering-grounds. They are also much clearer, more sparkling, and more palatable. There is an advantage also in temperature. The temperature is maintained almost absolutely constant throughout the whole year; in summer, therefore, they are cool and refreshing, and in winter they are removed considerably above the freezing point, and the risk of the freezing of the service-pipes is not so great. It is to waters of that kind that we refer, in our report of 1874, in these words: "Such waters are of inestimable value to communities, and their conservation and utility are worthy of the greatest efforts of those who have the public health under their charge." I have seen several hundred tons of the rock from which the water for Wakefield is to be obtained. It had been lifted out of the Wath Main. It appears to me to be admirably adapted for the effective filtration of water, and for the purification of water that has descended, very lightly charged with organic matter, from the surface to this depth. The organic matter will almost disappear after passing through a hundred feet or so of rock like that. I have made analyses of the specimens of the water intended to be supplied. The most important point, in this and in all analyses, is the quantity of organic matter present in the water. In this case it was exceedingly small. It is given under two heads in the table produced—organic carbon and organic nitrogen.

Results of Analysis expressed in Parts per 100,000.

Number of Sample.	Description.	Total Solid Impurity.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total Combined Nitrogen.	Previous Sewage or Animal Contamination.	Chlorine.	Hardness. Temporary.	Hardness. Permanent.	Hardness. Total.	Carbonate of Soda.	Magnesia.	Lime.	Silica.	Peroxide of Iron.
1876.	WATH MAIN WATER.																
March 5	From culverts	46·40	·088	·016	·018	..	·031	..	9·00	11·8	3·9	15·7	14·35	3·10	4·72	1·56	·10
„ 26	Stream below brick-kilns	48·24	·114	·038	·035	..	·067	..	9·20	10·1	3·1	13·2	15·65	2·95	4·20	1·20	·16
April 9	From culverts	36·60	·083	·032	·012	..	·042	..	4·15	11·7	4·6	16·3	6·99	3·70	4·91	1·80	·26
„ 23	From south downcast shaft	36·64	·087	·039	·028	..	·062	..	4·80	11·2	5·7	16·9	8·06	3·61	4·92	1·42	·56
„ 23	From north upcast shaft	41·96	·087	·036	·026	..	·057	..	6·10	10·2	3·9	14·1	12·90	2·43	4·62	1·52	·32

In this water, the organic carbon and the organic nitrogen are low. Good mountain water generally contains nearly ·2 of organic carbon, and from ·2 up to ·4 of organic nitrogen. Then the ammonia is not the least important in the case of deep well water. It is true that the proportions of ammonia given in this table are larger than what are usually found in drinking waters from river sources, or from mountain sources, but the origin of this ammonia is very different from the origin of that which occurs in rivers, and shows that the water has been for a long time stored in the rock from which it was pumped. The proportion of ammonia has no import whatever as to the quality of the water for dietetic purposes; it is a practically harmless ingredient, and is present in very minute quantities. It sometimes shows that the water may have been contaminated with sewage, if it is a surface water, but there can be no such question here. It indicates nothing whatever that is noxious. Then there is a large proportion of saline matter in this water. This is also a very common thing in deep well waters. Some of the best deep well waters that I am acquainted with—and I may mention the Trafalgar Square water, which is specially supplied to Buckingham Palace for the use of the Queen and her household—contains a large quantity of saline matter, and a good deal of that saline matter consists of carbonate of soda and chloride of sodium. The total hardness of the Wath water is 15·7—*i.e.*, upon the 100,000 scale. Clark's scale is on the 70,000, so that the hardness upon that would be less. There are waters which contain a much larger proportion of magnesia than this. The water supplied to Sunderland, for instance, contains 4·0 of magnesia in the 100,000. The Wath water contains a minute trace of iron; so small, however, as to be quite immaterial. I may mention also another thing with regard to this water, that when it first rises from the pit it possesses a very faint smell of sulphuretted hydrogen—the same smell that the Harrogate water possesses in a very intense degree. This is due to the presence of a most minute trace of sulphuretted hydrogen, a thing of common occurrence in deep well water. The water which is supplied to Folkestone, for instance, from the green sand—a very pure water indeed—also contains, when it rises to the surface, this trace of sulphuretted hydrogen, but it disappears rapidly upon a mere momentary exposure to the air, so that it would be impossible to supply it to customers in that state. The tubes (produced) contain different waters, with the object of comparing the colour of them. One contains distilled water, the second the Wath Main water, the third the water at present supplied to Leeds, and the fourth the Loch Katrine water. There is a great difference in the colours, and this illustrates what I was saying with regard to the difference between deep well and surface waters. Surface water generally contains some matter, and is coloured, and has a slightly bitter taste, but these are not to be considered bad waters by any means. The Leeds supply is from the river Wharfe. There is no difference whatever between distilled water and this, because they are really one as pure as the other as regards organic matter. There is no trace, in any samples of the Wath Main water that I have examined, of "previous sewage or animal contamination." It is water of a most excellent quality; I know of scarcely any water in the kingdom that I should prefer for constant use. It is a very palatable water.

Mr. VENABLES: Do you know of any waters which you think sufficiently good, with larger quantities of chlorine in them than this?

Witness: Oh, yes. There is water supplied to Braintree, in Essex, which is fairly good water. I never heard any complaint of it, and it certainly is a water which is very free from organic matter, and quite suitable for domestic supply; but it contains 38·8 parts of chlorine, as compared with 9 parts in the Wath Main water. The well from which Harrow-on-the-Hill is supplied contains 16·5, and that is a most excellent water. The well at Trafalgar Square, which, as I said before, supplies Buckingham Palace, a few of the public offices, and one or two clubs, contains 16·55, which is nearly double the quantity contained in the Wath Main water. The Royal Mint well, which is a deep well in the chalk, below the London clay, contains 13·9; the well at Barclay's brewery 14; the well at the Albert Hall 15·1; the well sunk by the Midland Railway Company at St. Pancras, yielding beautiful water for domestic supply, although it is not used for that purpose, contains 11·12; and the well at the water-works at Witham, in Essex, 15·2 parts of chlorine. The chlorine in the Wath water is principally chloride of sodium. The hardness I do not think objectionable for domestic use. For manufacturing purposes I should, on general grounds, object to a water so hard as this, but the special manufactures carried on at Wakefield do not require so soft a water as most manufacturing operations carried on in this country. I give that opinion from experience, having seen manufactures carried on in the West of England, where some of the finest woollen cloths in England are made, and where the water is considerably harder than the Wath Main water. The water at present supplied to Wakefield has a hardness varying from about 13° up to nearly 16°. There is a larger proportion of the sulphates of lime and magnesia in it. Soft water, as a rule, is better adapted for manufacturing purposes than hard. There is only one manufacture that I can call to mind at the present moment in which hard water is better, and that is the brewing of pale ale. In the woollen manufacture the quantity of water used is much less than in the manufacture of calico, and, therefore, soft water is not of paramount importance in a woollen district, as it is in a cotton district. I know many towns which are supplied with a harder water—London, for example. All the chalk waters are, without exception, harder. I have a list of 20 or 30 towns which are supplied with harder water. The sample of water, in the table, which was sent to me on the 26th of March, contained a slightly larger proportion of organic matter than the first sample. I should not have taken a sample from such a spot, because the water there had passed through a large pond containing refuse matters of various kinds—woollen rags, old casks, and moreover, a considerable quantity of fœcal matter, which was lying about on the bank of this pond in immediate proximity to the water, and would effect it in wet weather. However, it did not seem that the water had been much injured by passing through the pond. The sample sent me on the 9th of April was similar to the first, but it contained a less proportion of saline matter. The last sample, in the table, was taken by myself on the 23rd of April. At that time the pumping was going on from the shafts. All the samples are substantially of the same quality; they are all excellent waters, and fit for dietetic purposes and domestic use generally. They differ in respect to the total saline matters, varying from about 36½ parts up to 48 parts in 100,000. They also differ in the quantity of carbonate of soda. I have also analyzed some samples of water taken from the present supply. They were sent to me in sealed bottles, and I am not aware that the points from whence they were taken were stated to me. [Witness handed in the following table.]

Result of Analysis expressed in Parts per 100,000.

Number of Sample.	Description.	Total Solid Impurity.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total Combined Nitrogen.	Previous Sewage or Animal Contamination.	Chlorine.	Hardness. Temporary.	Hardness. Permanent.	Hardness. Total.	Carbonate of Soda.	Magnesia.	Lime.	Silica.	Peroxide of Iron.
1868. Sept. 15	PRESENT SUPPLY AT WAKEFIELD.	44·76	·431	·062	·001	·065	·128	337	4·47	5·9	9·5	15·4	..	..	..	..	..
1869. Sept. 18		40·00	·437	·049	·004	·095	·147	660	4·19	7·8	5·8	13·6	..	..	..	..	..
1874. June 10		38·12	·431	·095	·010	·104	·207	800	4·7	8·7	7·0	15·7	..	..	..	..	..
1876. March 19		24·90	·117	·045	..	·148	·193	1160	2·23	4·7	8·3	13·0	..	2·75	4·55	0·92	·26
	STREAMS USED FOR WOOL-DYEING.																
April 9	Balne Beck	66·32	·212	·039	·018	·548	·602	5310	4·30	21·5	12·3	33·8	·60	7·64	12·35	1·20	·60
„ 9	Chald Beck	66·40	·171	·042	·014	·291	·345	2710	5·15	12·1	26·4	38·5	·54	7·40	11·83	0·90	·30

I think the company have done the best they could, being confined to this water. They have surprised me in making it as good as it is; chemically speaking, I could not have thought it possible. The quality of the proposed supply is such that it will not incrust boilers. It is admirably adapted for steam purposes. The carbonate which it contains prevents incrustation. It is a material which is put into hard waters intentionally, in order to prevent incrustation by these ordinary salts.

Cross-examined by Mr. LITTLER: I am perfectly certain, from the chemical composition of the water, that it will not cause incrustation. This is exceedingly desirable in a town like Wakefield. The coal-measures water is of very variable hardness, which probably arises from the great variety of rock entering into the composition of the carboniferous series. Taking samples up and down in the coal measures, you get very different samples indeed; but from the same rock in the same district the difference of a couple of thousand feet would not exhibit great variableness. I have not examined any other than the Wath Main water in that district. The London water is about 22°, and some over 30° of hardness; this water varies from 14° to 16°. Once in the course of 11 years I met with a sample, delivered by the New River Company, which had something like 14° degrees of hardness; but it would be wrong to assume that such water is ever delivered in London.

Mr. LITTLER: In the report of the Rivers Pollution Commission, you say, "Hard water not only acts injuriously when it is used for washing, but when

it is employed for the generation of steam it forms troublesome and dangerous incrustations in the boiler. A constant supply of hot water has become almost a necessity in every household, but great difficulties are thrown in the way of its attainment by the supply of hard water to towns, owing to the formation of thick calcareous crusts in the heating apparatus."

Witness: That remark will not apply to this water, on account of the carbonate of soda that it contains. The carbonate of soda is a well-known material which prevents incrustation.

Cross-examination continued: The proportion of magnesia is something like 5 grains per gallon. This proportion is of no importance whatever. It may be as small as ·75 in New River water, but I think it is a little higher. It is small in the Kent water. There are several water supplies from the dolamite, which have a double quantity of lime and magnesia. I do not think there is any sulphate of magnesia in this water at all. I cannot tell whether the proportion would be as high as 14 grains. I do not think it possible, by chemical analysis, to ascertain how much of each of those salts is present. If you ask me how much magnesia is present, how much lime, or how much sulphate of sodium, I cannot tell you. It is not the case that when magnesia is present in quantity the soda must be present as a solvent, or *vice versâ;* there is too much sulphuric acid present, and too little carbonate of soda. I have not determined the sulphuric acid here, as I did not consider it important at the time I made this analysis.

Mr. LITTLER: Let me ask you whether you now agree with what you said the other day, in the Stockton and Middlesbrough Committee, with regard to the consumption of water from colliery pits—an illustration of which you gave: "This village—a village in Switzerland—derived its supply from a spring which, therefore, *primâ facie*, would be considered to be a very good source, and the water would not be likely to be suspected. At the other side of a hill of considerable magnitude there was a farm-house, and in this farm-house three cases of typhoid fever occurred. About 16 or 18 days after the occurrence of those cases of typhoid fever, a violent epidemic of the same fever broke out in this village of which I am speaking, and it was then found, on investigation, that the effluent waters from some irrigation meadows at this farm went directly through the mountain into the spring—that it was filtered through the porous material of the mountain. That was clearly proved by putting, first of all, salt into the water; the salt was found to come out of the spring used by the inhabitants of the village. A quantity of flour was then stirred up with the water—several hundredweights of flour—so as to make a magma of starch granules, which are known to be very fine indeed. This magma of starchy matter was poured into the hole through which the irrigation water had disappeared, and into which the salt had been put, and no trace of the starch granules made their appearance at the opening, thus showing that the water was very efficiently filtered (in the ordinary acceptation of filtration) in its passage through the hill; nevertheless, there was a violent epidemic of typhoid fever, in which 100 people were attacked in a small village of 60 or 90 houses. This occurred through the use of the water."

Witness: There is no parallel between the two cases at all.

Mr. LITTLER: If Wath and Wombwell are both on this very rock, and within a very short distance of this pumping-station, is there no parallel?

Witness: No; the water filters through rock from an old glacier there; the one being loose gravelly material, and the other the rock, a specimen of which you see on the table. I do not mean to say there are not cases in which the water goes through fissures, but in this particular case in the Wath Main the water had passed entirely through the pores. If any considerable quantity had gone through fissures instead of the pores, the quantity of organic matter present must have been considerably greater than it was. According to my theory, a very small quantity does the mischief, and if you could establish a conduit from these villages to the Wath Main, you would have a very good case for them.

Mr. LITTLER: I will just read you this—"*Q.* Has science yet been able to separate matters of the kind you have been describing, that are likely to produce disease? *A.* No efficient means are known for the separation of such matters. It is believed, and with very great probability, that boiling the water would destroy the noxious quality of this poisonous material."

Witness: That refers to artificial means; of course there are natural means of filtration through rock of this kind; that is not included in that answer. This is natural filtration through a compact rock; that was natural filtration through loose gravel. There is quite enough carbonate of soda in this water to prevent incrustation. I made inquiry from the engineer at the Wath Main Colliery where there were seven or eight large boilers constantly using this water, and he said there was no trace of incrustation in them.

FRIDAY, MAY 12.

Professor *J. T. Way*, examined by Mr. VENABLES.

I am a Professor of Chemistry, and have had 25 or 30 years experience in the examination and analysis of water. I was formerly chemist to the Royal Agricultural Society, and was a member of Lord Essex's commission on sewage. I was also a member of the first commission on the pollution of rivers. As a member of that commission, I had opportunities of becoming acquainted with the river Calder. We made a report upon it. It is an exceedingly foul stream. I have made myself acquainted with the state of the water supplied to Wakefield after going through the process of filtration.

The CHAIRMAN intimated that the committee did not require further evidence as to the state of the Calder.

Examination continued: On the 4th of April last I received two bottles of water for analysis. They were from the north and south shafts of the Wath Main. I analyzed those waters in conjunction with Mr. Ogston, and now produce a table showing the results:—

Wakefield Waters—Way and Ogston.
In 100,000 Parts.

	Wath Main Colliery.		Town Supply, April 9.
	March 30.	April 16.	
Chlorine	8·84	4·79	2·47
Sulphuric acid	3·11	4·10	9·11
Lime	4·96	5·60	5·70
Magnesia	3·23	3·37	2·67
Silica, oxide of iron, &c.	0·29	0·39	0·44
Soda	16·34	11·74	7·70
Carbonic acid (as carbonates)	11·34	11·16	
Loss on burning (organic matter, &c.)	1·71	2·86	2·28
	49·82	44·01	30·37
Ammonia	0·009	0·010	0·005
Albuminoid ammonia	0·001	0·004	0·006
Hardness—			
Temporary	14·0	13·3	6·0
Permanent	2·1	2·4	11·7
Total	16·1	15·7	17·7
Carbonate of soda per gallon	10·63	7·34	None.

This table shows that the water is very pure, and very good for domestic purposes. It is a very soft water after it has been boiled, in which state it would be used for most manufacturing purposes. I do not think the quantity of magnesia is objectionable. I am not a medical man, but I should not think it would be prejudicial to health. I have examined numbers of waters with quite as much magnesia in them.

Mr. VENABLES: How much water do you think a man must take absolutely to produce any bad effects from the magnesia?

Witness: I do not think anybody could drink enough of the water to enable the magnesia to be injurious; it would be a very large quantity to give as a dose of magnesia, understood as a chemical substance.

The CHAIRMAN: More than a person could drink?

Witness: Oh, yes.

Mr. VENABLES: It would take 50 gallons of that water to make a dose?

Witness: Some one has calculated that.

Examination continued: I have compared the amount of magnesia in a certain bulk of water with the amount of magnesia in a certain quantity of potatoes. I found that a pound of potatoes contained as much magnesia as a gallon of water. I do not think that that or any other ingredient of the water would be injurious. I have tested the Wath Main Colliery water myself. The water was at that time tubbed back. I examined the culverts from the shafts. They are brick culverts, and I believe the water comes through them direct from the pumps. The proper place to take the water, I should say, would be immediately as it issues from the culverts. The place from which the corporation took their samples was, clearly, not a proper place, because there it had received, or was liable to receive, other sources of water, and there was the possibility of pollution. The nearer the source, the fairer the sample would be. Hard water is generally supposed to settle in boilers; the lime and magnesia and the earthy compounds are supposed to, and in fact do, incrust the boilers. I understand this water does not do so, and the reason I take to be this: There is a very unusual condition of water here: the large quantity of carbonate of soda causes the lime and magnesia to be deposited very rapidly when the water reaches a certain temperature, and instead of being gradually deposited on the iron surface of the boilers, as in the ordinary cases, they separate in the water itself. I saw one of the boilers of the Wath Main pumping-engine opened, and as far as I could judge, without going into it, there was no deposit, and the men declared there never was one.

The CHAIRMAN: I have got your answer, that owing to the quantity of carbonate of soda in this water, it causes the magnesia and other substances to solidify, and to form in suspension at a certain temperature?

Witness: Yes, and more rapidly at a lower temperature. That is my explanation of a fact. Of course, I might not have thought so before I had known the fact.

Cross-examined by Mr. MICHAEL: It is the quantity of lime and magnesia present which determines whether the water is hard or soft. The difference between a soft and a hard water is expressed in "degrees of hardness," which means the quantity of soap that is destroyed by the water. I could not say this was a hard water, because there are many waters much harder; neither is it a soft water. I do not think there is any hard and fast line between the two. The usual supply in London has about 13° or 14° of hardness per gallon, which would be 20 in 100,000 parts.

Mr. MICHAEL: You multiply, in fact, the 7 by 10, or reduce it from 10 to 7—70,000 grains as against the 100,000. It is very easy to reduce your 100,000 scale to a gallon merely by multiplying by 7 and putting the decimal point further back. There can be no confusion on that ground.

Witness: Quite so.

Mr. MICHAEL: I want to know whether there is not a kind of standard adopted by chemists, that beyond a certain point you would call water hard, and below it you would call it soft?

Witness: I am not aware of any such standard. It must be necessarily capricious. If such a standard were to be adopted, I think it would be fair to take a large water supply, such as London, and say that is an average water supply.

Cross-examination continued: The presence of magnesia does not interfere with the hardness; it interferes with the determination of the hardness. I do not take the hardness to depend simply on the number of grains of carbonate of lime which are contained in the water. I am undoubtedly favourable to a supply of soft water, both for domestic and manufacturing purposes, where it can be obtained. In the neighbourhood of Mansfield, I believe, water is procured from the dolamite formation, and drunk by the inhabitants. I cannot tell from memory the quantity of lime and magnesia in that water. There are some large towns in the North—not a great many—where water is obtained from the same formation.

Mr. MICHAEL: May I take it generally that a supply of water from the magnesian limestone is extremely rare as being used by a large community?

Witness: From the magnesian limestone, but not with larger quantities than this.

Mr. MICHAEL: Will you give the committee an instance where water containing so large a quantity of magnesia as this is used by large communities?

Witness: The Rivers Pollution Commissioners, in their last report, have, I think, given a great number of instances.

Mr. MICHAEL: They have only given one single instance, and that is Sunderland. I ask you to point me to something else. Where, in your experience, are there towns using water with so large a quantity of magnesia per gallon as is contained in this water?

Witness: I am not prepared to answer the question.

Mr. MICHAEL: You have devoted, I may say, the whole of your life to the question of water supply, and yet cannot you give me a single instance?

Witness: A great deal of my experience of water supply has been in supplies for towns, and not of towns. In examining the supplies previously, a great deal of my work was done in connexion with the Board of Health, and that was with regard to proposed supplies; but whether they came into operation afterwards or not I do not know, but I was looking through some analyses of that kind the other day, and there were a great number of samples with more magnesia than this. I cannot say whether any of these were adopted.

Mr. MICHAEL: The very presence of the magnesia may have been the element which prevented the water being supplied to the town?

Witness: I do not think so.

Mr. MICHAEL: Have you any reason for saying you do not think so?

Witness: I cannot give you instances.

The CHAIRMAN: He cannot give the explanation.

Mr. MICHAEL: I hope I am not unduly pressing this matter, but you see the importance of it. Mr. Way is a gentleman whose experience is very great, and I acknowledge his authority, and ask for his experience upon this point.

Witness: I had an impression that you would have had it from other sources.

Mr. MICHAEL: We have not. I understand you to say that this water is very unusual from containing a large quantity of carbonate of soda?

Witness: Yes, except that deep waters very often do contain that.

Mr. MICHAEL: Can you tell me any large towns where the water contains such large quantities of carbonate of soda?

Witness: I do not know.

Mr. MICHAEL: You have given me the magnesia as 3·33 and 3·37; that does not represent the magnesia in the form in which it is found in the water. It is combined with some acid?

Witness: Yes, carbonic acid.

Mr. MICHAEL: I do not think there is any disagreement between us; I

only want it before the committee. I think it will work out to 4·6 into carbonate?

Witness: It would be 4·74.

Mr. MICHAEL: I give it you a little against myself. How much would it be as representing sulphate of magnesia, or Epsom salts?

Witness: It would be rather more than that.

Mr. MICHAEL: Would it be three times as much, taking it, you know, as crystallized sulphate of magnesia? How many grains would it represent?

Witness: As nearly as possible, six times as much—*i.e.*, 28 grains of sulphate of magnesia.

Mr. MICHAEL: Are you quite right in saying that the ordinary dose of carbonate of magnesia is as much as is contained in 50 gallons of this water, or, working it out, 235 grains to an ordinary dose? Is not the ordinary dose something about 10 or 15 grains?

Witness: Precisely. Carbonate of magnesia in that case is, I was going to say, hardly a medicine; it is used simply to allay acidity. I did not say the 50 gallons was my calculation; I said somebody had worked out that. After all, it is an absurdity, of course.

The CHAIRMAN: I am not clear about it. What is the absurdity?

Witness: Fifty gallons of water; it is only a form of speech to say that a man would take 50 gallons of water.

The CHAIRMAN: But then there are 235 grains in it?

Witness: In 50 gallons.

Mr. MICHAEL: The witness told you that the ordinary dose of magnesia is what would be contained, according to his analysis, in 50 gallons.

The CHAIRMAN: That would be about 5 grains per gallon?

Witness: Yes, it is shown to be so—4·74 grains of carbonate of magnesia in the gallon.

Mr. MICHAEL: You see you were not quite accurate in telling the committee that 235 grains was the ordinary dose.

Witness: That was put into my mouth.

Mr. MICHAEL: But with great deference to you, as a scientific man, is it right for you to adopt what is put into your mouth?

Witness: I did not adopt it; I said it had been calculated.

Mr. MICHAEL: I understand you to tell the committee that when this water is boiled, the reason why you think there will be no furring is that there will be a precipitate formed rapidly, which would fall to the bottom of the condensing vessel. What is to become of that after a long use of the vessel?

Witness: It will be blown out when the boilers are blown out, which is done every six weeks, or oftener.

Cross-examination continued: We have determined the sulphates in the water. It is not given in the form of a sulphate, because it is impossible for any one to say how these things are combined; we can only judge. To a great extent it is left an open question whether it is sulphate of soda or carbonate of soda; carbonate of magnesia or sulphate of magnesia. Taking chlorine, for instance, our first examination gave 8·84, our second 4·79; so that, in round numbers, the one exhibited 100 per cent. more than the other. I do not think I should be called upon to account for that difference.

Mr. MICHAEL: Will you account to the committee how so great a difference occurs in the constitution of waters, taken from the same source, and with a fortnight only intervening between the periods at which they were taken?

Witness: The only explanation that I can offer is this, that the rock from which the greater part of this water comes is, I understand, of great thickness, and developed over a large area. In all probability the water from that rock would be always of a similar composition, and in boring down through the rock, or in making a shaft through the rock, they tub back the water of the upper strata, and also the waters of the rock themselves as they go down. I believe these are, in some cases, imperfectly tubbed back in the operation of sinking the shaft, and some of the waters of the other strata get in, and that must be, more or less, according to the depth at which the boring has been made. I believe it to be a purely accidental circumstance, and that the water from the rock itself, which is the water the company would take, would be always of the same composition.

Mr. MICHAEL: According to you, therefore, they have obtained a very much larger quantity from some purer source, in order to obtain this, containing only 4·79 of chlorine?

Witness: It is impossible to say; but what I do say is, that if the water were taken from one depth, it would be most likely all of the same composition.

Mr. MICHAEL: Then at different depths the water must be of different quality as regards purity?

Witness: Not at different depths in this rock, but at different depths in the water-bearing strata through which it is now going. I think both these waters were taken from the same stratum, and that the 8·84 of chlorine is the quantity from this rock. The probability is, that if there is any alteration in the water, it would be in the direction of its being less, as it is a very pure rock from which the water comes.

Mr. MICHAEL: We have heard otherwise, that it is a mixed rock, and that there are various beds of shell and other matters which prevent it being a pure rock. Let me take this as a scientific problem for you to answer. Where you have, within a fortnight, so great a variation as 100 per cent., have you any guarantee that there may not be, in the next fortnight, as great a variation on the other side, so as to give you double the quantity of chlorine?

Witness: I think it would be very unreasonable, because, after all, this is a large quantity of chlorine for water; it is unusual to find it in water.

The CHAIRMAN: Is this chlorine deleterious?

Witness: Not at all; it is common salt.

Mr. MICHAEL: Does it not frequently happen in these formations that you have so large a quantity of salt developed in various parts that you cannnot use the water?

Witness: Yes, it might be so; it entirely depends upon the area of this bed which is the water-bearing stratum.

Mr. MICHAEL: I ask you again: You positively say that after having had so great a variation as 100 per cent. in one direction you may not have—although you say this is a very large proportion of chlorine—as great a variation in the other?

Witness: No, I cannot say so, but I can say this: The probability is you will have better water than this. The probability is that if you were to bore the rock and take the water you would get better water. It is clear to me there are strata furnishing different classes of water.

Mr. MICHAEL: What are the strata which would furnish dangerous water?

Witness: I do not say dangerous; it would be objectionable, certainly.

Mr. MICHAEL: Is it not a fact that in these formations overlying the coal beds it does frequently happen that there are such large depositions of salt as to prevent the water being used?

Witness: I believe there are beds of salt.

Mr. MICHAEL: You have no guarantee that in boring for this water in the coal measures you may not come upon such quantities of salt as may affect the quality of the water?

Witness: That is not a geological but an engineering question, which I am not competent to answer. I should take it for granted that it is within the power of an engineer to keep that water out. The company would not propose to take in water that is objectionable. They might in that way, to a certain extent, lessen their supply.

Re-examined by Mr. VENABLES: There is nothing at all deleterious in the quantity of chlorine which is given in the first column of the table. If there should be found to be a bed of salt in the rock, I should think it would be easy enough to keep the water from it. It is a singularly pure rock in itself. It is a sandstone rock, which is, of all rocks, the best as a water-bearing stratum. As to the magnesia in the water, we have reason to believe it is carbonate of magnesia; but, to prevent a discussion amongst chemists, the usual and proper way of putting down these things is as we have put them down upon this table. At the same time, I do not think you could find one chemist in a dozen who would dispute the fact that this magnesia must be put to carbonic acid, and not to sulphuric acid. That being so, there would be no harm in it, nor in the carbonate of soda, nor any other constituent of the water.

Mr. VENABLES: Then, after all the suggestions which have been put to you, in the form of questions, do you retain the opinion that this is a proper water for the supply of the town?

Witness: I think it is an exceedingly good water; certainly, so far as the ordinary organic elements are concerned, it is wonderfully pure. I do not suppose it is asserted, and I do not think there is any reason, that there is anything in the mineral portions of the water that would make it unhealthy.

By the CHAIRMAN: The only difference in the water, as shown in the two columns, of March 30 and April 16, is the variation in the quantity of common salt. The new supply to the town would be much less hard than the present supply. The present supply is never soft water, whether boiled or not.

(To be continued.)

Miscellaneous News.

METROPOLIS GAS SUPPLY.

CAMBERWELL VESTRY.—At the meeting of this vestry, on the 20th inst., the Finance Committee reported that a notice had been received from the South Metropolitan Gas Company, to the effect that Parliament having, by the Company's Act of 1876, imposed the duty of raising the illuminating power of the gas supplied from 14 to 16 candles, the company would, at the expiration of the present quarter, be under the necessity of reducing the discount on the public lamp accounts from 12½ per cent. to 7½ per cent. The condition on which the discount was allowed—viz., payment within one month, would be continued as before. Mr. Drayner, who brought up the report, remarked, in reference to the gas question, that the result of reducing the discount would be to cause an increase of 5 per cent. in the charge for public lamps, which would make £350 in the aggregate. The vestry paid £4 5s. per lamp to the South Metropolitan Company. The increase would be just 4s. per lamp. But they must bear in mind that they would get for the increased charge an equivalent in the shape of an extra illuminating power, from 14 to 16 candles. He submitted a resolution to the effect that the public lighting and proposed charge for meters be referred to the General Purposes Committee for inquiry and report. It was supposed that, from the accounts received in relation to the public gas supply in other parts of London, they would in a short time be enabled to get rid of the increased charge. Mr. Fermor seconded the resolution. Mr. Sugden was rather surprised to hear that the chairman of the Finance Committee had taken such a happy view of the matter. He considered that they were entirely in the hands of the company. He should be extremely glad to hear of the Government or the public authorities purchasing all the gas companies. He condemned the charge for meters, and contended that the consumers were paying for that which they did not consume. Mr. E. Dresser Rogers was of opinion that the best thing they could do on the present occasion was to say as little as possible, and remarked that some persons outside thought that the action of the vestry had produced the increase to 16-candle illuminating power. The company had done that, inasmuch as it was proposed in the bill, and Parliament conceded it, but with 3s. 9d. as the initial price. All the vestry did was to ask for 3s. 6d. as the initial price. He did not think 2d. per 1000 feet was too much to charge for two extra candles; but he did think it was a paltry thing for the company to charge meter-rents. The recommendation of the committee was adopted.

METROPOLIS WATER SUPPLY.

The Fifth Annual Report of the Local Government Board, 1875-76, which was laid before Parliament during the last session, and has just been issued, contains the yearly reports of Major Bolton, Water Examiner, and Mr. Allen Stoneham, Government Auditor of the Accounts of the Metropolis Water Companies, appointed under the Act of 1871.

REPORT BY MAJOR FRANK BOLTON, *Water Examiner.*

4, *Broad Sanctuary, S.W., Jan.* 31, 1876.

Sir,—As water examiner appointed under the Metropolis Water Act, 1871, I have the honour to submit a report of the results of the examinations made and various duties performed by me, connected with the water supplied to the Metropolis by the eight metropolitan water companies, during the year 1875.

Acting in compliance with my instructions, I have made monthly examinations of the various metropolitan water-works, and have duly reported the results of such examinations to the Local Government Board.

It is the duty of the water examiner under the Act of 1871 to ascertain whether or not the companies have complied with the requirements of section 4 of the Act of 1852, which enacts that "every company shall effectually filter all water supplied by them within the Metropolis for domestic purposes, before the same shall pass into the pipes for distribution."

Effectual filtration of water depends upon—

1. A sufficient area of properly constructed filter-beds, constantly cleaned and fresh sanded.
2. The rate of filtration being controlled, and limited to a certain speed in proportion to the area of filter-beds.
3. The water delivered into the filter-beds having been previously stored in subsiding reservoirs, and the capacity of these reservoirs being such as to avoid the necessity for the intake of turbid and muddy water during the time of extraordinary and heavy floods, which tend to foul and choke the filters.

In addition to inspecting the filter-beds and reservoirs, and examining the quality of the water, both at the intake and after filtration at the works, I have included in my reports the following information and particulars respecting each of the metropolitan water companies:—

1. The source of supply.
2. The situation of the works.
3. Total volume which may be supplied daily, in gallons.
4. Average daily supply during the month, in gallons.
5. Per centage delivered for other than domestic purposes.
6. Number of houses supplied.
7. Number of houses on constant supply.
8. Estimated population supplied within the districts of the water companies.
9. Number of subsiding and storeage reservoirs for unfiltered water, showing the area in acres and available capacity in gallons.
10. Number of current reservoirs for filtered water within the radius prescribed, showing the capacity in gallons.
11. Engine power, and horse power thereof.
12. Number of miles of mains in each district.
13. Number of miles of mains in the Metropolis.
14. Number of miles of streets with mains constantly charged, within the Metropolis.

15. Number of hydrants erected within the Metropolis, and number of fire-plugs.
16. Greatest lift by steam power.
17. Greatest and least head of pressure in the district supplied.
18. Number of filter-beds, with area in acres.
19. Depth of sand and other materials composing the filter-beds.
20. Average rate of filtration per square foot of area, in gallons per hour.
21. Number of acres of filter-beds cleaned during the month.
22. Appearance of water before and after filtration.
23. Statement as to progress of works and alterations made by each company, and of the works that should be undertaken.
24. Analyses by Dr. Frankland of the water supplied.
25. The same reduced to grains per gallon, for comparison with the analyses furnished by the companies.
26. Analyses of the water, made for the companies, and, in the case of the Kent Water-Works Company, the particulars of their wells.

The following are the alterations and additions made to the works of the companies during the year 1875, and the steps that have been taken by them towards providing constant supply.

1.—The Kent Water-Works Company.

About 650 houses have been put on constant supply during the past year, making a total of 6100 houses in their districts, principally in Deptford and Plumstead; the company have given notice that it is proposed to extend the system to two districts in Woolwich, containing about 800 houses.

A covered reservoir has been constructed at New Cross, to hold about 1,750,000 gallons, to provide for efficient constant supply to Peckham.

2.—The New River Company.

The company are engaged in the sinking of a new well into the chalk formation at Turnford, to obtain at that place a fresh supply of water, by a large boring into the lower green sand. This boring was commenced at the beginning of 1874, and it had reached a depth of 740 feet from the surface in November last; at this depth it had entered the marl below the chalk, and it is now being widened out to the diameter of 34 inches, preparatory to the insertion of the tubes which will be required for further boring through the marl and gault. To provide for the increasing demand of their district, the company are making several important additions to their distributory works, to effect the separation of the very different levels of their service into convenient zones, and to add to the power and means of communication by which their different stations are enabled to assist one another.

The new works at Hornsey include five new filtering-beds, of a joint area of 3½ acres; four new engines, of a joint power of 440 horses; a new high service reservoir on Crouch Hill, capable of holding 12 million gallons; and about 13 miles of large mains, to be laid down as lines of communication between the works just described, and for connexion with existing pipes.

Considerable additions were made by this company during the year to the number of houses, in courts and alleys in the City of London, brought under constant supply. Negotiations are still pending with the City authorities for the erection of fire hydrants.

3.—The East London Water-Works Company.

This company have completed the extension of the constant supply system in a considerable portion of their district, which is densely populated; the additions comprise 9231 houses, making a total of 57,714 houses out of 107,851. Notice has also been given of their intention to increase this number by about 3000 houses early in 1876. The system is to be completed, section by section, throughout the whole of their district.

4.—The Southwark and Vauxhall Water-Works Company.

The covered service reservoirs at Nunhead, to contain 18 million gallons, have been completed, and the mains for distribution from them to the lower districts, comprising Kent Road, Bermondsey, Rotherhithe New Road, Camberwell, and Peckham, have been laid. Additional boilers and works are being constructed at Hampton, and the company are erecting extra engine power for high-pressure constant supply.

The construction of further subsiding reservoirs by this company, to avoid taking in water when floods prevail, is to be proceeded with. Arrangements are being made for the acquisition of suitable ground for the reservoirs near the intake.

5.—The West Middlesex Water-Works Company.

A new 68-inch cylinder engine, of 120-horse power, has been erected at Hampton.

Constant supply is being given to a number of houses on the application of the owners, and the company are fully prepared to extend the system when called upon.

A new filter-bed at Barnes, of two acres area, is in course of construction. This increase in the filtering area is intended to provide for exceptional and extraordinary circumstances.

6.—The Grand Junction Water-Works Company.

A high service reservoir near Kilburn, capable of containing 6 million gallons, for constant supply, was completed in 1874, and the line of main-pipes to connect up this reservoir with the works at Campden Hill has since been laid. New boilers and works at Hampton are being erected, and for this place also an additional 70-inch engine of 125-horse power is being constructed; an extra 30-inch main from Hampton to Kew has been laid down, also a new 12-inch main from Kew to Notting Hill, to supply the low service in this portion of the company's district.

The company have decided upon constructing further impounding reservoirs, and negotiations are pending for obtaining the requisite land.

The capacity of the filter-beds at Kew has been increased by about 5 million gallons, by raising them about 8 feet.

7.—The Lambeth Water-Works Company.

This company have completed the extensions and improvements in their new works at Molesey; when full, the new reservoirs contain about ten days supply. The pumping-mains are being laid to pump to the reservoir about to be made at Norwood. This company are giving constant supply, by means of stand-pipes, in a number of courts and alleys. The alterations in fittings under the Board of Trade rules and regulations are being gradually effected as occasion offers, and are carried out in all new buildings. The company shortly intend to extend their area of filtration.

8.—The Chelsea Water-Works Company.

The new works were sanctioned on the 29th of June last, and are now progressing rapidly. The new pumping-main has been laid, and the water can now be taken in from the Thames at West Molesey, instead of at Seething Wells. The impounding reservoirs are also progressing, upon the land (comprising an area of about 50 acres) necessary for their construction, at Molesey. The erection of the necessary engine power is in progress; meanwhile temporary engines have been fixed, to afford supply from the new intake, and the company are endeavouring to complete the new works as soon as possible. The urgency of this is apparent, as, at the present time, they have no subsiding reservoirs; they have to take in their supply from the river day by day, and it is only by the exercise of the greatest care and attention to their filter-beds that they are able to supply clear and properly-filtered water to their districts.

During the year 1875, I have, on several occasions, been specially appointed to hold inquiries, and report upon various matters connected with the water supply of the Metropolis, amongst which the most important are as follows:—

February	*Richmond* water inquiry.
February	*Athenæum Club* water supply. Two special inquiries and reports.
March to July . . .	*West Kent Drainage Bill.* Corresponded and reported thereon. Was called and gave evidence before the Committee of the House of Commons on the bill.
May to December . .	*St. Olave's Union.* Several inquiries into complaints from the guardians of the union were made, and eventually a meeting was arranged between them and the directors of the Southwark and Vauxhall Water Company, and a temporary arrangement effected until the new reservoirs at Nunhead are taken into use.
October	*Kew Gardens Water Supply.* At the request of H.M. Office of Works, an inquiry was held and report made; and suggestions as to the future supply were also made and adopted.
	The *Metropolitan Board of Works* applied for, and were furnished with, information on various matters connected with the water supply of the Metropolis.
	The *Chelsea Water-Works Company's* Bill was also passed during the year. Attended parliamentary committee and gave evidence.

Since the passing of the Act of 1871, the water companies have, of their own accord, and in consequence of the recommendations of the Board of Trade and Local Government Board, incurred and undertaken a considerable expenditure. The total certified expenditure of the companies to Dec. 31, 1875, as will be seen by the following statement, is £11,296,206 9s. (of which £359,434 16s. 2d. has been expended during the period embraced in this report), to extend the storage capacity of their reservoirs, and increase the areas of their filters, as well as to provide for the requirements of constant supply by the construction of high-service reservoirs for filtered water, and by the addition of powerful machinery to their works; these measures have, without doubt, materially improved the water supply of the Metropolis.

Statement of the Expenditure by the Eight Metropolitan Water Companies, on Works, Improvements, &c.

Name of Company.	Expenditure to Dec. 31, 1874.	Expended during the Year 1875.	Total Certified Expenditure.
1. East London	£1,895,348 9 9	£2,738 3 1	£1,898,086 12 10
2. West Middlesex	903,152 18 11	13,542 13 10	916,695 12 9
3. Lambeth	1,141,778 15 9	73,927 10 5	1,215,706 6 2
4. Grand Junction	1,118,775 12 6	71,953 9 6	1,190,729 2 0
5. Southwark and Vauxhall .	1,708,324 6 0	58,579 18 1	1,766,904 4 1
6. New River	2,727,949 3 10	64,252 6 4	2,792,201 10 2
7. Chelsea	914,411 8 2	65,561 4 9	979,972 12 11
8. Kent.	527,030 17 11	8,879 10 2	535,910 8 1
	£10,936,771 12 10	£359,434 16 2	£11,296,206 9 0

The extension of the constant supply system by all the companies, and the construction of additional subsiding and impounding reservoirs by the Grand Junction and Southwark and Vauxhall Companies, remains still to be done. This latter work, however, has been decided on in the case of each of the two named companies, and will be proceeded with shortly.

The number of miles of streets containing mains constantly charged, and upon which hydrants could at once be fixed, in each district of the Metropolis, are as follows:—Kent, 80 miles; New River, 169; East London, 70; Southwark and Vauxhall, 100; West Middlesex, 70; Grand Junction, 41½; Lambeth, 90; and Chelsea, 50; making a total length of 670½ miles, while the total number of hydrants erected thereon is at present only 2622.

The chief officer of the Metropolitan Fire Brigade reported to the Metropolitan Board of Works that the number of fires attended by the brigade during 1875 was 1529, and that the quantity of water used for extinguishing the same was rather more than 10½ million gallons, two-thirds of which quantity was taken from the street-pipes, the remainder having been taken from the river, canals, and docks. The total quantity used, therefore, from the water companies resources, during the year, appears to be less than one-tenth of the minimum daily average supply of water to the Metropolis. The chief officer also reports that during the year there were four cases in which there was a short supply of water at fires.

The analyses of the water supplied by the water companies for 1875, as furnished by Dr. Frankland to the Local Government Board and by the water companies, have been given in the monthly reports. The numbers, however, in which these analyses are expressed, differ; those of Dr. Frankland being in 100,000 parts and the others in 70,000 parts (or grains per gallon); therefore, for easy comparison, the former quantities have been reduced to the latter, and shown in a separate tabulated form. Dr. Frankland's reports also show the results of microscopical examination.

The sources of supply of the water used in the Metropolis in the districts supplied by the undermentioned water companies are as follows:—

1. Kent Water-Works . . .	The chalk wells between Crayford and Deptford.
2. New River.	The River Lea, and wells at Amwell End, Amwell Hill, and Hoddesdon. The total volume which may be taken daily being unlimited.
3. East London Water-Works .	The River Lea, from which the quantity that may be abstracted daily is unlimited; and from the Thames at Sunbury, the volume to be abstracted daily at this place being limited to 10 million gallons.
4. Southwark and Vauxhall Water-Works	The Thames at Hampton.
5. West Middlesex Water-Works	
6. Grand Junction Water Works	
7. Lambeth Water-Works . .	The Thames at Molesey.
8. Chelsea Water-Works . .	The Thames at Ditton and Molesey.

The volume which may be taken daily is limited to 20 million gallons for each of the last five companies.

From the reports made by Dr. Frankland during the past year it appears that notwithstanding "the greater care exercised by most of the companies in the storage and filtration of the water, the organic pollution contained in the Thames water delivered in London, though subject to fluctuations from the greater or less prevalence of floods, does not diminish."

This statement tends to show that the deterioration of the waters of the Thames and Lea by sewage pollution continues, and points to the necessity of measures being adopted to prevent the contamination of these rivers and their tributaries (so long as they are the authorized sources of supply of the Metropolitan water companies) by the people living on the upper reaches, who now treat the tributary streams, as well as the rivers, as common sewers, both at their sources and during their course.

It must also be borne in mind that the population of the country through which the Thames and Lea flow is reported to be rapidly increasing in density, thereby tending to establish centres of pollution for the metropolitan water supply.

As before mentioned, the water companies have, since 1871, greatly increased their reservoirs, storeage capacity, and filters, and in consequence the quality of the water has considerably improved. Previous subsidence and storeage greatly facilitate the effectual filtration of water. Filtration to be effectual should be slow, and should not exceed 2½ gallons of water per square foot of properly constructed filter-bed per hour. The water companies now nearly all keep within this limit, but it is disheartening to reflect that, notwithstanding the efforts that have been made and the large expenditure that has been incurred in works for properly treating and improving the quality of the water when collected, these efforts are rendered nearly abortive, and but of little value by the continued and apparently increasing contamination of the waters of the rivers Thames and Lea on the one side, and by the apathy and carelessness of a great number of the consumers on the other. If this continuous and progressive pollution goes on, either a purer source of supply for the Metropolis should be found, or the present source must be rendered purer before the water is taken in by the companies; while every exertion must be made and means adopted by the companies, after the water is taken by them, to deliver it to their districts effectually filtered and of a wholesome quality. The water delivered for domestic purposes is frequently deteriorated after leaving the companies mains, by the dirty state of the cisterns on the premises of the consumers. Many of the cisterns, tanks, and butts for containing water in small tenement houses in the Metropolis are in a disgusting and filthy state. An opportunity for inspecting these presents itself when travelling on some of the metropolitan and suburban lines. Cisterns may be seen without lids, full of rank and decaying vegetation, which on closer examination would show more or less organic deposit, and under the microscope would be found to abound in infusorial life. All cisterns should, therefore, be frequently cleaned out, and every care should be taken to prevent the contamination of the domestic supply after delivery.

It appears to be the rule, in building a certain class of houses, to place the cistern over the water-closet, with an untrapped waste-pipe communicating with the drains. These cisterns are frequently open, and regularly receive the drippings from the roofs and gutters; they are moreover often in close proximity to the dust bins and other deposits of filth and garbage, while children amuse themselves by throwing all sorts of dirty rubbish into the water. The purest water in England would be poisoned by such a system of storeage.

The Public Health Act of 1875, section 70, gives power to any local authority, in case of complaint, to inspect and remedy such evils. I am, however, decidedly of opinion that the only remedy for this state of affairs will be found in the establishment of the constant supply system, and the consequent total abolition of the intermittent system; meanwhile, and until the constant supply is completed, the owners and occupiers of houses are highly culpable in permitting such a condition of things to exist.

In courts and alleys several of the water companies are already giving constant supply by means of stand-pipes, provided, in most cases, with self-closing taps, and in the districts of those companies which are extending the constant supply—viz., the East London, Kent, and New River—a marked improvement has taken place in the quality of the water consumed by the small householder, which thus reaches the house in the same condition as it leaves the companies mains.

In the better class of houses, and in many public buildings, the cleansing of cisterns and tanks is frequently neglected for months, and, in some cases, years are permitted to pass without any examination or cleansing taking place.

In my monthly reports on the metropolitan water supply, I continue to draw attention periodically to the necessity which exists for the regular cleansing of cisterns, and also to the fact that the contamination of water from the gases generated by sewage is of far more frequent occurrence than is generally understood. Waste-pipes from cisterns are still to be found in direct communication with the sewers, and the gases thus flow back into the cisterns and become absorbed by the water. To prevent this the overflow-pipe should be brought outside the house and the end left exposed to the air, instead of being carried into the drain, as is often the case. By the adoption of this plan the poisonous effluvia and gases from the drains will be got rid of; these would otherwise ascend through the pipe, and not only be partly absorbed by the water in the cistern, but be mixed with the air in the houses, thereby becoming a cause of fever and disease. I have, &c.,

FRANK BOLTON, Water Examiner.

The Right Hon. the President of the Local Government Board.

REPORT BY ALLEN STONEHAM, ESQ.,

On the Audit of the Accounts of the Metropolitan Water Companies during the Year 1875.

Local Government Board, Whitehall, S.W., Dec. 31, 1875.

My Lords and Gentlemen,—In compliance with your instructions, I have the honour to acquaint you with my proceedings in regard to the audit of the accounts of the metropolitan water companies during the year ended the 31st of December, 1875.

No new point of interest has arisen during that period, but a practice which attracted my notice soon after my appointment in 1871, and which indeed I hoped had been settled, has again forced itself on my attention. I refer to the practice of some companies obtaining, from their bankers or from other sources, temporary loans, ostensibly for capital purposes, but really to enable them to carry on their daily operations pending the collection of the water-rents.

The question arose on the accounts of the Lambeth Water-Works Company, and an analysis of the balance-sheet for the half year to the 30th of September last will help to elucidate the matter, but my remarks will apply with equal force to the accounts of the Grand Junction and the Southwark and Vauxhall Water-Works Companies, analyses of whose accounts I also subjoin.

LAMBETH COMPANY.

I.—*Capital Liabilities.*

Capital received and not yet appropriated		£34,194 13 10
Due to contractors		3,847 10 7
		£38,042 4 5
which consists of the following assets:—		
Stores in stock		£6,050 7 5
Cash		19,783 7 3
Owing by revenue		12,208 9 9
		£38,042 4 5

II.—*Revenue Liabilities.*

Undivided profit		£35,724 19 6
Interest accrued due		4,004 7 0
Debts due	£10,249 4 5	
(Including temporary loan of £1000.)		
Less debts recoverable	431 13 1	
		9,817 11 4
Contingency-fund		8,418 1 9
Owing to capital		12,208 9 9
		£70,173 9 4
Consisting of the following assets:—		
Water-rents due to company	£65,055 17 7	
Less provision for bad debts	4,600 0 0	
		£60,455 17 7
Stores in hand		1,299 10 0
Consols		8,418 1 9
		£70,173 9 4

From the foregoing, it will be seen that the Lambeth Water-Works Company, in addition to borrowing the sum of £1000 for revenue purposes, had also borrowed £12,208 9s. 9d. for like purposes from capital, and that of this sum £8418 1s. 9d. had been invested in Consols as a contingency-fund. It will be further seen that the undivided profits consist of uncollected water-rents.

The accounts of the Southwark and Vauxhall and Grand Junction Companies for the same period exhibit similar features, viz.:—

SOUTHWARK AND VAUXHALL COMPANY.

I.—*Capital Liabilities.*

Capital received but not yet appropriated		£23,499 15 11
Due to contractors and others		1,693 14 10
		£25,193 10 9
Consisting of the following assets, viz.:—		
Cash		£2,531 12 3
Owing by revenue		22,661 18 6
		£25,193 10 9

II.—*Revenue Liabilities.*

Undivided profit		£24,711 11 7
Dividends and interest due		15,132 2 5
Debts due by company on revenue account		5,325 16 0
Temporary loans		2,500 0 0
Owing to capital		22,661 8 6
		£70,331 18 6
Consisting of the following assets, viz.:—		
Water rents due to company	£72,070 6 7	
Less provision for bad debts	3,500 0 0	
		£68,570 16 7
Stores in hand		1,760 11 11
		£70,331 8 6

GRAND JUNCTION COMPANY.

I.—*Capital Liabilities.*

Capital received but not yet appropriated		£3,470 18 0
Due to contractors		6,043 4 7
		£9,514 2 7
Consisting of the following assets, viz.:—		
Cash		£2,246 1 2
Owing by revenue		7,268 1 5
		£9,514 2 7

II.—*Revenue Liabilities.*

Undivided profit		£34,515 9 2
Dividends and interest due		3,977 13 9
Debts due by company		3,990 8 3
Temporary loan		18,000 0 0
Owing to capital		7,268 1 5
		£67,751 12 7
Consisting of the following assets, viz :—		
Water rents due to company	£70,891 18 2	
Less provision for bad debts	3,600 0 0	
		£67,291 18 2
Stores in hand		459 14 5
		£67,751 12 7

In the last-mentioned cases it will be observed that the temporary loans amount to more than £25,000 in each instance, while the dividends payable on the ordinary shares or stock are about £22,000 and £31,000 respectively.

With the view of clearly following the financial operations of the various companies, I have from time to time prepared analyses of their accounts, similar to those given above, and the examination of these, in the case of the companies referred to, inevitably opens the question as to the limitations which ought to be imposed upon any company in regard to the practice of borrowing for purposes of revenue, whether the loan be raised directly from the company's bankers, or whether it be derived from capital in the shape of a balance of capital money habitually kept in hand and temporarily appropriated towards defraying current expenditure. If a loan be raised towards paying a dividend, and all loans for revenue purposes are ultimately in aid of dividend—if, in other words, a company is distributing a dividend, fairly earned, without having the cash actually available to meet the payment—then it seems reasonable, if the practice is permissible, that the interest of such a loan should be charged as a payment in aid of the parliamentary dividend. But the latter practice of using capital moneys for revenue purposes pending their final application to the extension of the works seems to me faulty in principle and not consistent with the satisfactory administration of the finances of a company.

A question of this kind must obviously be settled rather by considerations of wise policy and sound administration than by reference to any express legal enactment. The legal powers of a company in regard to the application of capital to revenue purposes have not, so far as I am aware, received any definite legal interpretation; and in the discussion of any question that may arise, the solution is more often to be sought for in the very nature of capital and revenue respectively than in any definite provision to be found in an Act of Parliament concerning them. This being so, I have not regarded it as any

part of my duty to express an opinion as to the amount of unexpended capital which a company may hold in hand. When works of great magnitude are in progress, especially when, as has been for some time the case with the water companies, extensions of a special kind have been desired by the public and sanctioned by the Legislature, it may well happen that a company will retain a balance of capital moneys at its bankers. As, however, such moneys can ultimately be appropriated to one purpose only—viz., the extension of the plant or works of the company, it is obvious that the directors ought not to rely upon such funds as a means for defraying accruing revenue liabilities, pending the conversion into cash of the water-rental which has been earned by the company. But in the cases to which I have referred, the regularity with which an excess of capital has been allowed to remain in the hands of the companies leads to the conclusion that the directors have relied upon that balance to aid them in the discharge of the general liabilities of the companies.

It should be borne in mind that the profit shown on the half-yearly revenue account of any water company generally consists of the difference between the accrued rental due at the date of the account, on the one hand, and the accrued liability for management and maintenance on the other. The accrued rental not being collected at the date of the account, the payment of a dividend out of such profit should properly be deferred till the rental has been realized. But beside the cash for the dividend there should clearly be enough in the till of the company to meet the current expenses as well, and until that result has been achieved, no efforts should be spared to expedite the collection of the rental, and any attempt to pay a higher dividend than can fairly be met without recourse to temporary loans should be discouraged. Moreover, in the decision as to the amount of dividend to be paid, not only should it be considered whether the dividend has been really earned, but attention should also be paid to the amount of cash which will remain after payment thereof for current disbursements. Now it will be readily seen that the possession habitually of a large sum of unexpended capital money will, by its effect in systematically replenishing the cash balance, inevitably tend to weaken the incentives to prompt collection of income, and to judicious abstinence in the division of profits which are naturally suggested and enforced by the contemplation of a scanty exchequer.

I am not unaware that the practice now under consideration is one of which many examples may be found amongst public companies. Indeed, this would naturally be the case, because the policy operates directly towards the maintenance of higher dividends. I have, however, felt it to be my duty to comment upon it, with the view of introducing a sounder and healthier system.

Apart from the aid given to revenue by the use of capital moneys for other than capital purposes, another question of great importance arises. A water-works company with many miles of pipes underground in various states of repair, with a complex machinery for the collection, filtration, and distribution of water, must necessarily be subject to accidents of a more or less serious character. A company dividing the whole of its profits is obviously at a disadvantage in regard to expenditure forced upon it by accidents or exceptional works in the way of renewals or repairs.

The Acts governing the majority of the metropolitan water companies contemplate, although they do not enforce, the setting aside of a contingency-fund to meet outlays of this description, and in the carefully managed companies this very necessary object would be accomplished by leaving a reserve of undivided profits on the dividend and interest account. But in a company where the profits are divided to the full extent, the unwillingness of a board of directors to propose to their shareholders a reduced dividend naturally inclines the minds of all the *employés* of a company to unduly charge the capital account with sums that should be placed to the debit of revenue, and hence discussions constantly arise, and appeals are continuously made to the auditor to pass questionable items as capital instead of as revenue charges.

The foregoing remarks lead to the consideration whether it is not a duty incumbent on companies conducting operations on a large scale, such as gas and water companies, annually to set aside from their accruing profits a certain sum to form a depreciation-fund.—I have, &c.

ALLEN STONEHAM,
Auditor appointed under the Metropolis Water Act, 1871.

The Right Hon. the President of the Local Government Board.

Major Bolton reports that the water in the River Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated) was good on 18 days, and slightly coloured during the other days of the month of August. The highest flood state of the river was 4 inches above the (6 feet) summer level, and the lowest was 3 inches below summer level. The highest temperature of the water taken at Teething Wells was 74°, and the lowest 59°, while the highest temperature of the air at the same place was 95°, and the lowest 62°. The condition of the water in the river was good on 22 days, and indifferent on 8 days, when it was slightly stained. These observations were made daily at 9 a.m. The rainfall for the month was 1·35 inches.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held on Thursday, the 21st inst., at the Albion Hotel, Aldersgate Street—ERASMUS WILSON, Esq., F.R.S., in the chair.

The SECRETARY (Mr. Magnus Ohren) read the advertisement convening the meeting, and the following report was presented:—

The directors report that the general working of the company during the half year has been satisfactory.

The directors have announced a further reduction in the price of gas to 3s. 11d. per 1000 cubic feet from and after Michaelmas quarter.

It is considered desirable to convert the existing capital of the company into stock, and a resolution will be submitted to the shareholders accordingly.

The reports of the gas examiners of the parishes supplied by the company, on the illuminating power of the gas, and its freedom from sulphuretted hydrogen and ammonia, continue to be satisfactory; the average result of their examinations has given an illuminating power of 15·67 standard sperm candles.

The accounts annexed show the financial position of the company. After carrying £1000 to the reserve-fund, the balance of profit and loss account amounts to £9643 18s. 3d. Out of this sum the directors recommend the declaration of a dividend for the half year ending the 30th of June last as follows—viz., at the rate of 6 per cent. per annum on the preference capital, at the rate of 7 per cent. per annum on the ordinary 7 per cent. capital, at the rate of 10 per cent. per annum on the original capital, at the rate of 7 per cent. per annum on the converted 7 per cent. capital, and at the rate of 10 per cent. per annum on the converted 10 per cent. capital; all less income-tax. This will absorb £9038 5s., and leave £555 13s. 3d. to be carried forward to the profit of the succeeding half year.

Dr. REVENUE ACCOUNT, *for the Half Year ended June* 30, 1876. *Cr.*

To Manufacture of gas—						By Sale of gas—				
1. Coals, including all expenses				£18,429	15	1	Lady-Day quarter—			
2. Purifying materials, wages, &c.	£1,011	12	9				1. Private rental—			
Less spent oxide sold	218	12	1				93,010,100 cubic feet, at 4s. 1d.	£18,989	11	2
				793	0	8	7,363,600 cubic feet, at 4s.	1,460	14	2
3. Salaries of engineer and officers				473	15	0				£20,450 5 4
4. Wages and gratuities				2,601	15	7	2. Public rental and under contracts			1,698 4 7
5. Works, machines, retorts—maintenance of, repairs, & labour	£4,430	1	8				Midsummer quarter—			
Less old material sold	6	3	9				3. Private rental—			
				4,423	17	11	48,763,900 cubic feet, at 4s.	9,752	15	6
						£26,722 4 3	433,300 cubic feet, at 3s. 10d.	83	0	11
Distribution of gas—							1,686,200 cubic feet at 3s. 7d.	302	2	7
6. Salaries of chief inspector, inspectors, and clerks in light office				612	11	8				10,137 19 0
7. Mains and service-pipes, repairs, maintenance, renewal, and labour				667	13	0	4. Public rental, and under contracts			1,718 16 8
8. Meters, repairing, renewing, and refixing				1,110	8	0	5. Meter-rental—the half year			580 18 10
						2,390 12 8	Total rental			£34,586 4 5
Public lamps—							Residual products—			
9. Lighting and repairing						710 11 7	6. Coke, less labour and cartage	7,414	7	11
Rents, rates, and taxes—							7. Breeze, ditto	141	17	0
10. Rents				14	13	6	8. Tar, ditto	1,985	16	4
11. Rates and taxes				1,302	4	8				9,542 1 3
						1,316 18 2	9. Sulphate of ammonia and ammoniacal liquor, less labour, &c.			436 8 9
Management—							10. Sundries			40 16 5
12. Directors allowances				500	0	0				
13. Salaries of secretary, accountant, clerks, and messenger				433	16	4				
14. Collectors commission				747	2	8				
15. Stationery and printing				248	3	0				
16. General establishment charges				442	2	4				
17. Auditors				30	0	0				
						2,401 4 4				
Sundries—										
18. Law and parliamentary charges						164 7 5				
19. Bad debts						211 7 8				
20. Horses and carts						338 15 8				
21. Insurance-fund						196 10 6				
Total expenditure						£34,452 12 3				
Balance carried to profit and loss account						10,152 18 7				
						£44,605 10 10	Total receipts			£44,605 10 10

PROFIT AND LOSS ACCOUNT (NET REVENUE), *for the Half Year ended June* 30, 1876.

1. To Reserved fund account—amount carried from the half year's profits				£1,000	0	0	1. By Balance from last account	£9,060	7	1
Balance of net profit to be carried to next account, subject to half year's dividends to June 30				9,643	18	3	Less dividend paid for the half year ended Dec. 31	8,685	7	6
										£374 19 7
							2. Balance brought from revenue account, being profit for the half year			10,152 18 7
							3. Interest on moneys deposited and on contingent-fund			116 0 1
				£10,643	18	3				£10,643 18 3

The CHAIRMAN, in moving the adoption of the report and accounts, said: Our position on the present occasion is very much like that which has lasted for a considerable number of years, one of steady, well-established prosperity and success. We have fallen again into our good old habits in the past, of commencing a reduction to our consumers in the price of gas, and, at the same time, are determined to give nothing but a first-rate article to them, feeling that that will be a very considerable and material element in the success of the company. You will have a matter connected with the capital of the company brought before you in a special resolution, and I need not say anything with regard to that, except, perhaps, that it will relieve us from the very long paragraph which usually terminates our report, which must be puzzling to many of the shareholders, and is calculated to throw some little perplexity into the distribution of our dividend. That little inconvenience, we hope, will be got rid of by the proposition that is about to be made in reference to converting our capital into stock. I have really nothing further to add on the subject of the report.

Mr. H. P. STEPHENSON (deputy-chairman) seconded the resolution, which was unanimously agreed to.

Mr. LINGING moved—"That a dividend at the rate of 6 per cent. per annum on the preference capital, a dividend at the rate of 7 per cent. per annum on the ordinary 7 per cent. capital, a dividend, at the rate of 10 per cent. per annum on the original capital, a dividend at the rate of 7 per cent. per annum on the converted 7 per cent. capital, and a dividend at the rate of 10 per cent. per annum on the converted 10 per cent. capital, all less income-tax, be now declared, and made payable forthwith."

Mr. LIVESEY seconded the resolution, which was agreed to.

Mr. STEPHENSON moved a resolution as to the conversion of the capital into stock. He said it was almost manifest to everybody that there was a very great advantage in so doing. In the first place, they would get rid of the converted 10 per cent. capital and converted 7 per cent. capital, and would consolidate the shares into a smaller compass. Then there would be the advantage that a person could sell a fractional portion of his stock; for instance, any one

holding £20 of stock could retain £13 and sell £7. A third advantage would be found in the distribution of new capital. At present they had £150,000 ordinary capital and £37,500 of loan capital, which had not yet been distributed to the shareholders. When that came to be distributed, if the shareholders held stock instead of shares, it would be effected more easily, because it would do away with the necessity of the fractional portions. The resolution was as follows:—"That it is desirable that the existing capital of the company be converted into stock, and that this meeting, with the consent of three-fifths of the shareholders here present, in person or by proxy, hereby determines that such conversion shall forthwith take place, and that the present 5000 10 per cent. preference shares in the capital of the company be converted into £50,000 worth of preference stock, bearing a preferential dividend of 6 per cent. per annum; that the present 7500 original and converted £10 shares in the capital of the company, bearing a dividend of 10 per cent. per annum, be converted into £75,000, 10 per cent. ordinary stock, bearing a dividend not exceeding 10 per cent. per annum; and that the present 12,500 ordinary and converted £10 shares in the capital of the company, bearing a dividend of 7 per cent. per annum, be converted into £125,000 7 per cent. ordinary stock, bearing dividend not exceeding 7 per cent. per annum, and that such stock so created as aforesaid be divided among the shareholders, according to their respective interests therein." This conversion, when it took place, would not in any way whatever reduce their interest in, or income from, the company.

Mr. CHARLES WILSON seconded the resolution, which was agreed to.

Mr. LAYTON moved the cordial thanks of the meeting to the directors for the care they had taken of the property of the company, for the good return they had made, and for their general management. There was no doubt about such a resolution being unanimously adopted. At the last meeting he drew attention to one or two facts with regard to the remuneration of directors of gas companies, and he was going to do so again, because since then he had heard remarks from several of the shareholders, which led him to believe that a favourable vote would be taken at this meeting. It was just after 1862 that the present remuneration of their directors was fixed, and at that time the paid-up capital of the company was only £81,000, whereas it was now £229,000. The rental of the company then was £10,745, while at present it was £35,232. The fact was, considering the capital employed in their business, the remuneration of the directors was the smallest of any gas company he knew. He felt sure he should carry the opinion of the meeting with him, when he said the directors deserved at their hands their consideration and best wishes. By increasing their remuneration, the dividend would not be in any way imperilled, and no injustice would be done to the public. He, therefore, proposed to add to his resolution a clause providing that the fees of the directors for the past half year, and for the future, be at and after the rate of £1500 per annum.

Dr. PUCKLE seconded the resolution. He said when he first became acquainted with the company, it was with a view of ascertaining if there were any weak points; but he must say unhesitatingly, for a suburban gas company he was quite certain no company were better managed, and very few as well. Considering the growth of the company, he was surprised that some increase in the directors remuneration had not been before proposed, but no doubt it was mainly due to the very great reticence and modesty of the chairman, who for some time said he should be very sorry that any proposition should be made for increasing the remuneration of the directors, unless it received the unanimous support of the proprietors. He felt that they had thoroughly earned some increase in the remuneration, and that they were at present very inadequately recompensed for the services they rendered. He was quite satisfied they had an honest and efficient board; and that being the case, the shareholders should see that their services were fairly paid for. He agreed with all that Mr. Layton had said, and had much pleasure in seconding the resolution.

Mr. WEBSTER, in supporting the resolution, said the wonderful growth of the company had been remarked by a great number of people. It had received no check, but had gone on progressively increasing in the returns every year. The shareholders were perfectly satisfied with the management of the company, and he had, therefore, great pleasure in supporting the resolution.

The resolution was then put to the meeting, and was unanamously agreed to.

The CHAIRMAN said the directors were very grateful for the manner in which the resolution had been put and carried. The proposal had come before the board on more occasions than one, but up to the present time they had not felt that they could accept it with the perfect freedom with which they could now do so. They were certainly very unwilling while the coal famine lasted, or when they were not in a position to make their usual reduction to consumers, to accept anything like increased fees; but that time had happily passed away, and he hoped would not again return. He trusted the success which had attended their exertions would continue. The directors, after carefully considering the question, as it was brought before them on a previous occasion, had come to the conclusion that this increase might be added to their remuneration without interfering in any way with the interests of the company, and he was quite convinced that, if any unforeseen occurrence did render it inconvenient to disburse so large a sum, they would immediately ask the shareholders to take back the addition which they had been so kind as to make that day. Before sitting down, he had to propose a vote of thanks to their auditors and officers. With all their good intentions the board would probably be unable to carry out their objects completely if they were not seconded by a body of officers who were united with themselves, and formed part of that brotherhood of which the company, he trusted, were a special example. With that resolution he might mention the names of Mr. Gray, Mr. Glaisher, and Mr. Ohren. The engineer (Mr. Watson) was, unfortunately, absent, in consequence of failing health, but they hoped when they met again he would be present.

Mr. BENGOUGH seconded the resolution. He was sure they were under very great obligations to their auditors, and their secretary was always most ready and willing to give shareholders every information. He believed there was not a better officer connected with any company, and that being so, they must make a good deal of him, and give him their most hearty thanks.

The resolution was agreed to.

Mr. GLAISHER, in responding, said he believed every officer in the company felt that he had a trust reposed in him, and so far as he knew his colleagues, they endeavoured to perform those trusts to the best of their abilities. As for their secretary, he had heard it said, that when complaints were brought to him, half the mischief was cured by the courteous manner in which he received every such application.

A vote of thanks to the chairman brought the business to a close.

SCOTCH FIRE-BRICKS.—At the late meeting of the British Association, Mr. J. Dunnachie read a paper before the Chemical Section, "On Fire-Brick," in which it was stated that the quantity of fire-bricks made in the Glasgow district, which is almost exclusively comprised in the counties of Lanark, Renfrew, and Ayr, amounts in ordinary times to 80 millions.

SELBY GAS SUPPLY.—The little town of Selby, imitating some of its burly brethren, is desirous of acquiring the gas-works, and taxing consumers for the benefit of the ratepayers generally. At the meeting of the local board, on the 21st inst., the clerk was directed to feel the pulse of the directors of the gas company on the question of the purchase, it being supposed that for about £10,000 the undertaking could be secured for the benefit of the town. As the capital of the company is £8000, it is probable that the local board may find they will have more to pay for their whistle than they yet dream of.

HULL HYDRAULIC POWER COMPANY.

On the 14th instant, the new works of this company were completed. Through the courtesy of their engineer, Mr. H. Robinson, of Westminster Chambers, we are furnished with the following particulars of this, the first undertaking carried out under Act of Parliament for supplying hydraulic power to a town.

In the year 1872 an Act of Parliament was obtained for the purpose of establishing at Hull, what was termed in the preamble of the Act, "a system for applying motive power by hydraulic pressure to waterside and land cranes, used for the purpose of raising and landing goods, and for working dock gates and other machinery." It also authorized the abstraction from the Old Harbour of the river Hull of an amount of water, not exceeding a million gallons a day, for distribution within the company's district, for which a payment was to be made to the corporation of £12 10s. per annum for each quarter of a million gallons, the water to be used for no other purpose than as a motive power, except with the consent of the corporation. A 6-inch pressure-main has been laid from the northern boundary of the defined area, near the Cottingham drain, in a southerly direction along Wincolmlee, Trippett, Dock Office Row, under the Old Dock Basin (which forms the eastern, or river Hull entrance to the Queen's Dock), and crossing this entrance it is laid along the whole length of High Street, terminating close to the western approach of the South Bridge across the river Hull. The length of pressure-main laid, exclusive of the dock crossing, is altogether 1485 yards, that on the north side of the dock entrance being 673 yards in length, and that on the south side 812 yards. In laying this main many obstructions were met with, in the shape of old sewers, gas and water pipes, gullies, &c., all of which had to be avoided. This involved much careful arrangement of bends and irregular pipes, and the difficulties were increased, as the streets through which the works were carried out had a heavy goods traffic over them, and in many parts, especially in High Street, were very narrow. An engine-house has been built to receive, eventually, four 60-horse power engines. As the ground beneath this site was silty and treacherous, the foundations had to be carried down 24 feet before a good bottom was reached on hard clay. The footings of the walls were built on a series of arches carried on concrete piers, which made sound and economical work. The engine-house is covered by a cast-iron tank. Two pairs of 60-horse power high-pressure horizontal pumping-engines have been erected, capable of pumping about 300 gallons per minute, at 700 lbs. pressure per square inch, with steam at 100 lbs. pressure, supplied by two Lancashire boilers, fitted with the most approved appliances. The water supply from the river Hull is filtered. One accumulator is erected at the pumping-station in Machell Street. It has a diameter of 18 inches, and a stroke of 20 feet. The case is loaded with 65 tons of slag and sand, which gives a pressure of 600 lbs. per inch in the main. The accumulator-case and cylinder rest on concrete piers carried down to the solid clay, and are enclosed in a brick tower. The supply of water is obtained from the river Hull, and is pumped through a 10-inch suction-pipe into the tank over the engine-house. The distance from the river to the pumping site is 125 yards, and the total height of the lift from low-tide level to top of tank is 35 feet. A centrifugal pump (in duplicate) fixed in the engine-house raises the water from the river to the tank. The water power supplied by the company will be paid for by the consumer at rates dependent on the amount of water used. The following tariff has been issued by the company:—One crane in one warehouse, £52 per annum; two cranes in one warehouse, £94 per annum; three cranes in one warehouse, £132 per annum; and four cranes in one warehouse, £166 per annum. Each crane will have a counter attached to it to register the amount of work done. One hundred tons may be lifted 40 feet, or 200 tons 20 feet, and so on, each day by each crane, for the above charge, which is under one halfpenny per ton for a lift of 40 feet. If more work than this is done, the extra work will be charged at the rate of 4s. for every additional 100 tons lifted 40 feet. Special rates will be made for working presses, hydraulic engines, capstans, small cranes, &c., as occasion arises. The consumer of the power effects a great reduction in his expenses where he is using hand power, and where steam power is used the engines, boilers, &c., can be dispensed with, by which the risk of fire is diminished, and the space occupied by them is made available for other purposes. He is further able to dispense with the skilled labour required to attend to them. The upper floors of warehouses can also be more utilized, and higher floors can be advantageously added to existing buildings. Hydraulic power is always and instantly available to meet the requirements of the consumer, and at a cost to him only in proportion to the power absolutely consumed, in the same way that he pays for gas, or the ordinary domestic water service. The works have been carried out by Mr. Henry Robinson, C.E., the company's engineer, assisted by Mr. F. W. Thornton, the resident engineer. The machinery was supplied by the Hydraulic Engineering Company, of Chester. Already the Dock Company have made arrangements for taking a 4-inch pipe from the Hydraulic Company's main for the purpose of working cranes and appliances at the Queen's Dock, and several parties in High Street are preparing to take the power.

ACTION OF IMPURE RAIN WATER ON LEAD PIPES.

By PAUL SCHWEITZER, Ph.D., of the University of Missouri.*

The laboratory of the University is supplied with water which collects in a tank in the upper part of the scientific building, and is carried to the working tables of the students by lead pipes, which are furnished with brass stop-cocks. In using this water for ordinary analytical work—as, for instance, saturating it with sulph-hydric acid—it was soon found to be unfit for such purposes, on account of the quantity of metals it had dissolved, after standing in the pipes for only a short time. It is a well-known fact that pure water attacks lead much faster than water containing a certain quantity of mineral salts, and this seems to be also the case with rain water, which contains invariably ammonia, nitrous and nitric acid; some sulphuric acid was also found in this water, derived from the smoke and cinders which fall on the roof of the building from the coal fires that heat the rooms. The following quantities of metals were found in one U. S. gallon of 231 cubic inches of the filtered water that had stood in the pipes for one month:—

1·079	grains	metallic	zinc.
0·537	,,	,,	iron.
2·503	,,	,,	lead.
0·082	,,	,,	copper.
0·049	,,	,,	arsenic.
4·250	grains.		

Arsenic, copper, and probably iron, are derived from the lead pipe manufactured from an inferior quality of lead; and zinc from the lining of the tank. In supplying private houses or institutions with water through a system of pipes, care should be taken to find out whether the water to be supplied be pure or not; in the former case, and when rain water is the source of supply, as it is in many sections of our State, lead pipes should be discarded, and tin-lined lead pipes substituted for them.

RIO DE JANEIRO GAS COMPANY, LIMITED.—The directors of this company have decided to pay an interim dividend at the rate of 10 per cent. per annum, free of income-tax, for the half year ended the 30th of June last.

* Read before the American Chemical Society, June 1, 1876.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There was some little excitement in certain circles here on Tuesday last, when it became known that Mr. John Bramnall (formerly a tool manufacturer) had filed a petition in bankruptcy, with liabilities amounting to £60,000; but the feeling was speedily allayed when it was ascertained that his stoppage would not at present affect any other large firm. Some further small failures may result, but they will not greatly affect commercial matters here.

In the iron trade there has been very little business done during the week, owing to the sittings of the Iron and Steel Institute, and of the British Iron Trade Association at Leeds, which have been attended by most of the leading men here. In pig iron the amount of business doing is still exceedingly small, although makers and merchants quotations are on an accommodating scale. A few parcels of foundry qualities from the Derbyshire and South Yorkshire furnaces have been disposed of at 53s. to 56s. per ton, but I do not hear of any lots of foundry iron having changed hands. From North Lincolnshire there is very little pig or ore being brought, many of the furnaces in the vicinity of Frodingham being out of blast. Seventy families are emigrating thence to New Zealand, in consequence of their continued inability to find employment.

In all branches of the iron industries there is a general and loud complaint, not only of the paucity of orders, but of the extreme difficulty of obtaining payments of accounts. For nearly 50 years there has not been such an outcry or so many complaints.

In house coal there is a visible and considerable improvement, deliveries on winter contracts with metropolitan and other merchants having commenced. As a consequence of this improvement the Dronfield Silkstone Company near Sheffield, and a firm near Barnsley, have advanced prices 6d. to 1s. per ton, making the second quality of the former company 11s. per ton. In locomotive and steam coal there is no nominal change. Some of the latter is being bought as low as 7s. 6d. per ton, although best qualities still realize 9s. to 10s. at the pits.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There has been a more active inquiry for gas-making coals, not only on account of contracts which have been already entered into, but on the part of consumers, who have not yet covered themselves for the winter, and with the close of the summer are becoming anxious to secure supplies. Holders of cannel exhibit a decidedly firmer tone, and at one or two of the large firms in the Wigan district, an advance of 2s. or 3s. per ton upon late quotations is talked about for next month. In ordinary gas-making coals there is also a tendency to stiffen, and buyers would find it very difficult to place contracts at the low prices which were very readily accepted a month ago. Fair qualities of screened Wigan four-feet cannot now, as a rule, be bought under 8s. 6d. or 9s. per ton, whilst for Arley, 10s. to 11s. per ton is being quoted.

In round coal for house fire purposes there has also been a steady improvement in the demand. Small quantities are now being taken out of stock, and in those districts where the pits have only been working three or four days per week, many of them are now being put on full time. This keeps supplies plentiful in the market, and although there is a disposition in some quarters to ask rather more money for forward deliveries, it is doubtful whether coal-owners will be able to obtain any material advance upon late rates next month. In other classes of fuel there is very little change to notice. The demand for ironmaking and general manufacturing purposes continues dull, and common sorts of slack are, if anything, rather more plentiful, with prices a trifle easier. Generally, however, there is no change upon late quotations, and the pit prices in the Wigan district remain about 10s. to 11s. per ton for good Arley, 8s. 6d. to 9s. for Pemberton four-feet, 6s. 6d. to 8s. per ton common coal, 5s. 9d. for burgy, and 3s. 6d. to 4s. 6d. per ton for slack.

There has been a little more doing in best and gas coal for shipping purposes; but common sorts continue a drug, and low in price.

In the iron trade, although there has been no material improvement in the demand beyond a few more inquiries for forge numbers, there is rather a firmer tone in the market, and north country makers are not offering at quite such low prices as they were. There is still, however, underselling in outside brands, and the local makers are securing little or nothing in the shape of new orders. They are, nevertheless, not disposed to give way in price, and list rates remain without change from last week. In finished iron there is also little or no alteration, except that for rails rather more money is being asked; but bars are still low in price.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

As was expected, there were pretty large arrivals of coasting vessels in the Tyne and Wear last week. A good few coasting orders were in the market, and nearly all the ready vessels were taken up quickly at an advance of 6d. per ton for the British Channel, and 3d. per ton for the east coast, with improved rates for London. London rates for steamships nearly touch 5s. per ton now, and to Rochester the same. The shipments of best gas coals are active, both by steamers and sailing vessels. Turns for the latter are from four to six colliery working days. The market for the better qualities of gas coals is stiffer; but there is no advance in price, nor is there likely to be. Collieries are willing to take contracts for the next six months at figures which have been current during the past month. Steam and household coals are also in demand, with turns corresponding to the above quotations. The shipping trade to the Baltic is very quiet, and the Mediterranean trade almost without change. Inferior coals of all kinds are in abundance in the market, and though things look a little brighter in local manufacturing industry, the price of all sorts of inferior coals, as reported last week, is unremunerative.

The iron trade of the Cleveland district has been undoubtedly firmer. There is not much prospect of prices getting lower, and buyers are inclined to come into the market and purchase. The production has been shortened. General trade is likewise a little firmer. The demand from America for chemicals is sustained, and the market is strong.

The Trades Union Congress held their sittings in Newcastle last week. There was a large attendance of representatives from all parts of the United Kingdom, and the most striking feature was the fact that the unskilled town labourers, as well as the agricultural labourers, had sent their representatives. Gas men were not directly represented; though the London cabmen were. The debates were mostly upon trade legislation, and a good deal of attention was directed to the movement for the compensation of workmen who might be injured whilst following their employment. A special committee of the House of Commons have been inquiring into the subject, and the Parliamentary Committee of the Congress were directed not to have anything to do with legislation of a permissive character bearing upon it.

Mr. G. Lefevre, M.P., will in all probability make his award with regard to the proposed reduction of wages in the Durham mining district this week. Dr Lyon Playfair, M.P., and the arbitrators will open their court of inquiry in relation to the proposed reduction of wages in the Northumberland district this week likewise.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The agitation in favour of the adoption of Sir Windham Anstruther's Burghs (Scotland) Gas Supply Act has now begun to take some shape. At a special meeting of the Town Council of Dumfries, held last Friday, it was unanimously resolved, on the motion of Mr. Wood, to adopt the Act, and the first Friday in December was fixed as the date on which the council, as reconstituted by the November elections, should meet to confirm this resolution. The Police Commissioners of Bridge of Allan have also resolved to adopt and apply the Act, and they have appointed Tuesday, the 14th of November, for holding a second special meeting to resume consideration of the resolution arrived at. They have not committed themselves, however, to the statement that they will acquire the present or erect new gas-works.

A meeting of the Gas Commissioners of Forfar was held last Tuesday evening for the purpose of considering a proposal to increase the salary of Mr. Esplin, the manager of the gas-works. After some discussion, it was resolved that an increase of £10 per annum should be made, and that it should take effect from the end of the financial year. Bailie Grant, who moved the resolution, said that Mr. Esplin was well entitled to the advance. His salary had been fixed low to begin with, and the production of gas had increased by 3 million cubic feet since his appointment, while the expenditure had decreased. Bailie Lowson, the convener of the Gas Committee, thought the increase of salary quite called for, looking to the way in which Mr. Esplin had discharged his duties.

The Arbroath Town Council met on Friday, when it was stated that £494 4s. 2d. had been realized as profits from the Gas Corporation, and in terms of the Gas Act one-half of this amount must be handed over to the magistrates of the burgh.

During the week ending the 16th of September, according to Dr. Wallace's report upon the quality of the gas supplied to the city of Glasgow, the gas from the Dawsholm station was under 25 candles on three separate days, and the Partick gas was twice below the standard illuminating power. The highest maximum was 29·06 candles (Tradeston), and the lowest minimum was 23·89 candles (Dawsholm). The Dalmarnock gas had 12·46 grains of sulphur and 0·18 grain of ammonia in 100 cubic feet.

The average illuminating power of the Dumfries gas for the same week was 23·36 standard candles, whereas the average illuminating power of the gas supplied to other twelve cities and towns ranged (as per last reports) from 27·53 standard candles to 30·07, the price ranging from 3s. 9d. (Galashiels) to 5s. (Kilmarnock), that of Dumfries being 5s. 10d. per 1000 cubic feet.

The Edinburgh and District Water Trustees last week visited the sources of the water supply. They left Edinburgh in carriages at eleven o'clock, and first drove to the reservoirs at Alnwick Hill, where the new filtering-beds are in course of construction. Following the track of the new works, the company proceeded to Roslin, where they viewed the bridge which is being erected to carry across the pipes. They then continued the journey to the Moorfoots, and inspected the works there. The progress of the operations has been so rapid, that a complete transformation was found to have taken place since the trustees previously visited the place. The water was running full and clear. Altogether the members were satisfied with the appearance and progress of the works.

A movement is in progress for getting a fresh and more abundant supply of water for the town of Dingwall.

The inhabitants of West Kilbride, Largs, and Millport are organizing a strong opposition against Sir John Hawkshaw's scheme for discharging the sewage of Glasgow into the sea at Farland Point; and on Monday evening a meeting of the Sanitary and Social Economy Section of the Philosophical Society of Glasgow is to be held, for the purpose of reading and discussing the papers of Colonel Hope, V.C., and Mr. J. J. Coleman, F.C.S., on Sir John Hawkshaw's report, read at the late meeting of the British Association in Glasgow.

The pig iron warrant market assumed quite an animated tone during the past week, and on Thursday and Friday a good business was done at advancing prices. On account of a much improved continental demand, the lethargy which has so long characterized the trade has given place to life and activity. Shipping iron has been in great demand, principally for export to the Continent, and the result is an almost general advance of 1s. per ton. Business was done on Friday at 56s. 9d. cash, and 56s. 10½d. one month.

Coal shipping orders are scarce, but house coal is in better demand. Prices remain unchanged.

ADVANCE IN PETROLEUM.—One of the most remarkable commercial movements of the times is a rapid and extraordinary advance in the price of petroleum, during a period of depression in the current value of nearly all other American products. The extent of the advance is indicated by a recent newspaper statement that "one operator reported refined at 26 cents. per gallon bid with no sales. The advance in refined oil has been rapid. At the close of the week before last, 19 cents were offered by shippers, but refused; and, at the close of last week, 2000 barrels were sold at 22 cents per gallon. The oil clearances from Baltimore last week were 1,172,601 gallons, making the aggregate exported from Baltimore since Jan. 1, 1876, 24,899,275 gallons, against 16,843,828 gallons in the same time of 1875, or an increase of over 8 million gallons. The article has advanced 5 dols. per barrel in the past three months, placing millions of dollars in the pockets of petroleum speculators throughout the country." A short time ago the price of crude oil in the oil regions was less than 2 dols. 50 cents per barrel, but lately numerous sales have been made for more than 4 dols. Even on the 25th ult., the opening rate at Oil City was 2 dols. 90 cents, while on the following Monday, Aug. 28th, the closing price was about 4 dols. An Oil City daily paper says that on Aug. 28, 1875, the prices were as follows:—Crude, river shipment, 1 dol. 16¼ cents. United, at the wells, 90 to 95 cents. Refined, at New York, 11¼ cents. Antwerp, 25 f.

HYDRO-GEOLOGICAL SURVEYS AND WATER SUPPLY.—In the Mechanical Section at the late meeting of the British Association, Mr. Baldwin Latham, C.E., read a paper on this subject, his object being to point out the fact that much of the bad health prevalent in large towns is attributable to the unskilful manner in which the wells are constructed. He explained that the water-line in the earth was not a horizontal line, but had a considerable fall, being from 11 to 40 feet per mile in the neighbourhood of Croydon, and 2 to 90 feet in Norfolk. He then showed several illustrations of healthy and unhealthy residences, the water supply in the former being invariably above the cesspools or any other sources of pollution in reference to the subterranean movement of the water; whereas in the unhealthy examples the sources of pollution have generally been above the sources of water supply. Before constructing a well it is necessary to ascertain the direction in which the water is moving, and whether the well-water is the only source of supply, and then to place the well, in reference to the underground movement, in such a position that it cannot be contaminated by water sinking from cesspools or other sources of pollution. In towns, so great are the number of points of pollution that no well can be considered safe, and water, consequently, should not be taken from wells located in populous places. Mr. Latham pointed out that it was singular that while measures had been adopted for the prevention of pollution of streams flowing on the surface—and which, by the way, had never been traced to be the cause of the disease—no one had thought of the great evils that had resulted, and would result, from the pollution of underground sources of water supply. His object was to direct attention to this all-important subject, and to point out that in cases where the use of cesspools was unavoidable, there were ways in which they might be introduced without detriment to the health of the persons using water which can only be procured from the local wells.

NATURAL GAS.—An American contemporary says: "The Kanawha Valley is a gas region, all the salt wells yielding more or less gas, and several furnaces have run altogether with gas, using no coal. Slowly limestone incrustations formed in the gas-vents, obstructing the coming of the gas, so that by-and-by very little gas was given from the wells. Mr. Tompkins has been reaming his old gas-well, and has re-opened the flow of gas, and obtains enough to run his furnace. Pipes are being laid from his well to the Dickenson furnaces below, for there is enough gas wasted to run that furnace."

BOMBAY WATER-WORKS.—The Bombay Town Council, at their weekly meeting on Tuesday last, had before them, the finally revised tenders of Messrs. D. T. Stewart and Co. and Messrs. T. Edington and Co., and of Messrs. R. Laidlaw and Son and Messrs. R. Maclaren and Co., for the supply of ironwork for the new water-works. Messrs. Stewart's amended tender for delivery of 15,355 tons at Mahaluxmee amounted to £124,294 sterling, and that of Messrs. Laidlaw and Son and Messrs. Maclaren and Co., for the same quantity, to be delivered at the same place, to £123,607 or £687, less. The Town Council having previously resolved that the lowest tender would be accepted, the contract was accordingly given to Messrs Laidlaw and Son and Messrs. Maclaren and Co. The municipal commissioner calculated that the outlay on the accepted tender, allowing for the difference in exchange, will be 16,48,000 rs. Messrs. W. and A. Graham and Co. are the Bombay agents for the contractors, and the goods will be brought out by the steamers of the well-known Anchor Line.—*Bombay Gazette, Aug.* 18, 1876.

OPENING OF NEW WATER-WORKS AT GRANGEMOUTH.—On Tuesday, the 19th of September, the new water-works for the little town of Grangemouth, situate at the eastern extremity of the Forth and Clyde Canal, were formally opened with great *éclat*, the Countess of Zetland performing the interesting ceremony. The works, which have cost £10,000, have been constructed by Messrs. Bell and Miller, of Glasgow, under the superintendence of Mr. R. Niven, the resident engineer, Mr. K. M'Kenzie being the contractor. The supply of water has been obtained from three sources—viz., surface drainage, springs, and bores—the latter through sand, sandstone, and clay, to depths varying from 150 feet to 300 feet—which combined yield a steady flow of about 75,000 gallons daily, equal to 25 gallons per head per day, to a population of 3000 or 4000. The spring water, however, can, when required, be augmented to the extent of 40,000 gallons, and another source which may in time be taken advantage of are the springs adjoining the Millhall Burn, on the Earl of Zetland's farm of Gilston. The head works, which are constructed in the Millhall Valley, are close to the sources of supply, and consist of collecting wells and their conduits, a settling-pond, filter, and intervening regulator, valve well, sand washing-box, and clean water-tank and valve well. The water derived from the bores, though perfectly safe and wholesome, is in its original state considered rather hard for domestic purposes, owing to the presence of oxide of iron in considerable quantities; but this hardness is reduced to a minimum by exposing the water to the atmosphere in the conduit and settling-pond, the latter being constructed to contain a ten days supply. After leaving the settling-pond, the water is passed through a copper wire-cloth outlet screen, and after being submitted to filtration is stored in a tank 40 feet in diameter by 15 feet deep. The main delivery-pipe, 8 inches in diameter, is led from this tank through the valve well—where the supply of the town is regulated—and down the valley to Millhall Mill, then along the Statute Labour Road from Polmont to Reddoch, thence by the Bo'ness Road to Grangemouth. Distributing-pipes are laid through all the streets of the town. The better class houses will have service connexions with these pipes, but the greater part of the population will, in the meantime, be supplied from street wells, which have been erected at convenient places.

DEWSBURY NEW GAS-WORKS.—On Monday, the 18th inst., the Mayor of Dewsbury (Mr. F. Firth) performed the ceremony of turning on the gas at the new gas-works belonging to the corporation, and situated at Savile Town, close to the Lancashire and Yorkshire Railway, and also to the branch canal belonging to the Aire and Calder Navigation Company. The members of the Town Council were present, and also a number of burgesses. A few years ago the Dewsbury district was supplied with gas by the Dewsbury and Batley Gas Company, an undertaking which was not a great pecuniary success in the early years of its existence, but which for a long period prior and up to its dissolution, furnished maximum dividends to the shareholders. Its purchase by the two corporations of Dewsbury and Batley was a very expensive affair, the cost being, we believe, £266,000. The share of Batley was valued at £136,000, and what she got for that immense sum were the new works at Soothill, and plant in pipes, &c., extending along the streets of Batley, and of the greater part of Soothill Upper. Dewsbury's share, valued at about £130,000, consisted of the old works at Batley Carr, and the mains in her district, as above given. Besides that she has, in round numbers, expended about £65,000 at Savile Town, the works being, in many respects, second to none in the kingdom. The Batley Carr works (which belong to Dewsbury) will soon have to be dismantled, and the buildings sold for business purposes. It is, however, certain that whatever they realize will not very much reduce the outlay on gas supply of the Dewsbury Corporation, and that for many years to come, unless there be a great increase in trade and population, there is little likelihood of the price of gas being reduced to the figure at which many town authorities are supplying their customers. At the meeting on the 18th inst., Alderman Greenwood, the chairman of the Gas Committee, spoke of a reduction in price being likely to be made, but did not say to what extent it would be carried. He and the mayor said a few words about the works, as also did Mr. Craven, the engineer, under whose design and superintendence they have been carried out. The last-named gentleman also conducted the party round the works, and explained their construction. Mr. B. C. Cross, the borough surveyor, also said a few words, and the proceedings concluded with three cheers for the works, and three cheers for Mr. Craven, the engineer. When the ceremony of turning on the gas was over, the party returned to Dewsbury, where, at the Wellington Hotel, the Mayor and Corporation were entertained at dinner by the members of the Gas Committee.—*Leeds Mercury.*

ANALYSIS OF AIR IMPURITIES.—In the Chemical Science Section at the late meeting of the British Association, Mr. E. M. Dixon, Glasgow, described an apparatus for the analysis of impurities in the atmosphere. In this machine aspiration of the air is obtained by means of a pair of air-pumps, the piston-rods of which are connected with a beam, to either end of which the working handle can be attached. The air-pumps are connected directly with a reservoir of the capacity of about 8 cubic feet, and this reservoir again communicates with the atmosphere by six comparatively small tubes. Hence the working of the pumps gives rise on the one hand to a somewhat intermittent flow of air out of the reservoir through the pumps into the atmosphere, and on the other hand to a regular flow of air out of the atmosphere through the six tubes into the reservoir. The function of the reservoir is therefore simply to secure a steady flow of air in the direction of the pumps, notwithstanding their necessarily intermittent action. The air thus set in motion in several distinct streams towards the pumps is, before it reaches the reservoir, first freed from the impurities in it by washing, and then measured as it passes through dry gas-meters. The machine, Mr. Dixion went on to say, had been in regular use during last month, and had given results regarding the presumably very pure air prevailing in the district around the Mull of Kintyre that, so far as they have been worked out, appear to be quite reliable. The analysis of the samples of impurities was not yet quite finished, but Mr. Dixon had the opportunity of satisfying himself that the amounts, both of ozone and ammonia, were remarkably constant when the weather was dull and a fresh breeze was blowing either from the east or the west, while warm weather, accompanied with light winds, had the effect of more than doubling the amount of ammonia prevailing at other times, and when the amount of ammonia was exceptionally high, that of ozone was exceptionally low. A satisfactory estimation of neither ozone nor ammonia could be usually had from much less than 100 cubic feet of air, and about 12 hours were spent daily in drawing that amount of air through the liquids. These facts would not appear surprising when it was known that, on an average of 16 days, the amount of nitrogen existing as ammonia in 100 cubic feet of air was only the fiftieth of a milligramme, while the average amount of ozone existing at the same time in the same quantity of air was less than one-twentieth of a milligramme. The number which the author had given for the average amount of ammonia in the air of Kintyre during last month was very little more than a thousandth of that given by the late Dr. Dundas Thomson for the air in the central district of Glasgow during a certain period of 1848. Dr. Thomson found, as the result of one estimation lasting over nine days, that 126 cubic feet of air drawn from the outside of the then college laboratory contained 0·31 grains of ammonia. It should, however, be noted that during the time of his experiment a dull mist pervaded the city, the air was stagnant, and cholera was raging in the vicinity. Mr. Dixon concluded by stating that the machine he had described was evidently adapted to the estimation of noxious vapours of all kinds in the air. It was also suitable for the examination of vapours in chimneys, flues, drains, &c. In the discussion which followed the reading of this paper, Mr. Mactear described an apparatus of a similar kind in use at St. Rollox Chemical Works, and stated that he found it better to use wet rather than dry gas-meters.

Register of New Patents.

2772.—MILLS, B. J. B, Southampton Buildings, London, "*Improvements in liquid-meters.*" A communication. Patent dated Aug. 5, 1875.

This invention relates to the class of meters in which the flow of liquid is measured by the rotation of a screw or spiral shaft working within a casing and communicating with registering gear.

In the present invention the screw-shaft is made hollow to render it buoyant, and to reduce the friction upon its bearings. It revolves within a trunk of square, hexagonal, or other angular section with radial wings projecting inwardly from the corners to prevent the water from acquiring the rotary motion of the screw. The flow is from below upward. The lower or induction end of the trunk is provided with a valve of sufficient weight to cause a pressure below and around the trunk in excess of that within it. Oblique apertures are provided in the sides of the trunk arranged to cause jets of liquid to strike the blades of the screw in lines perpendicular to the surfaces on which they impinge.

The square trunk within which the screw rotates is fixed concentrically within the outer shell or casing of the meter by means of a flange projecting horizontally from the outside of the trunk and clamped between the upper and lower parts of the casing. The flange thus forms a partition between the induction and eduction chambers of the meter. The upper end of the screw-shaft communicates through its spindle with reducing gear consisting of cog-wheels and worms, and terminates in a crank-arm, which transmits rotary motion through a vertical crank-shaft to the registering gear. This crank-shaft is formed with a conical collar fitting a corresponding seat, and is pressed upward by a spring so as to produce a tight joint to exclude liquid from the registering chamber. Each wheel and worm, or each wheel and pinion, as the case may be, of the transmitting and registering gear is mounted in separate frames adjustably, so that it may be set and secured in proper relative position to work with ease and precision, and to permit removal for repair or cleansing.

The base-plate of the transmitting gear surmounting the screw chamber is constructed with a downwardly projecting cylinder or socket surrounding the upper end of the screw-shaft, and preventing lateral pressure by the current of water against the shaft. Radial wings project outward from this cylinder, and downward within the corners of the square trunk so as to unite with the internal diagonal wings of the trunk to prevent the water from acquiring a rotary motion.

The registering gear is enclosed in a dry bonnet and mounted on a plate screwed in the head of the meter, so as to ensure the parts being accurately in line.

2819.—LAKE, W. R., Southampton Buildings, London, "*Improvements in gas-burners.*" A communication. Patent dated Aug. 11, 1875.

The objects of this invention are, first, to provide a burner which will economically consume gas without noise, and whose parts regulating the supply can be easily placed in position, and easily exchanged without disturbing the adjustment of the pillar or the gallery supporting the shade; further, to make the pillar or burner holder adjustable, so that the gallery and shade can be adjusted horizontally, and permanently secured in that position. It comprises a gas-pillar, fitted with a ball-and-socket joint for the horizontal adjustment of the gallery and shade; also a tube, forming a double regulated gas-burner not supporting the gallery, and capable of being inserted into and removed from the pillar without disturbance of the other portions of the burner or the gallery. It also comprises a combination of parts to form a gas-pillar, having a ball-and-socket joint for the horizontal adjustment of the gallery and shade, and to form a ball-and-socket gas-burner, adjustable horizontally, and having a double regulated tip or burner, which may be exchanged or adjusted without disturbing the pillar or gallery.

2826.—HALLEWELL, R., Blackburn, "*Improvements in gas motor-engines.*" Patent dated Aug. 11, 1875.

This invention relates to motive-power engines worked by the explosion of gas and air, and consists in the employment of a small motor or engine formed similar to the ordinary double-acting condensing steam-engine, but acted upon by air instead of steam, and having the vacuum formed in a large and separate cylinder by the explosion of gas and air, the cylinder acting in a similar manner to the condenser of the steam-engine.

The vacuum cylinder is encased in a large jacket or cylinder open at the top and fixed to the foundation or bed, and containing water, which is allowed to circulate or be changed as required. In the vacuum cylinder is a piston sufficiently deep to be steady without requiring a piston-rod, and at the top of the cylinder there is a large valve, which can rise and fall. At the bottom of the vacuum cylinder is a passage for the entrance of the gas and air which have to be exploded, the supply and proper time of entrance being regulated by a valve or valves worked by the engine. Below the piston at the bottom of the cylinder there is a rocking rod and lever made to rise and fall by being acted upon by a tappet and lever. The rocking shaft carrying the lever passes through the side of the engine-bed or cylinder bottom, and may be kept tight by a stuffing-box, and on the shaft is a cranked arm pinned on the end outside the engine-bed or cylinder bottom. The arm is raised up and down periodically by the engine, and abuts against the middle of the piston, the object being to raise the piston high enough to allow sufficient air and gas to accumulate below the piston to permit of an efficient charge for the explosion. The valve or valves are again shifted in position, and bring a flame of gas to the explosion port, and the explosion taking place drives the piston to the top of the cylinder, the air passing through the valve at the top of the cylinder, and thus another partial vacuum is formed in the vacuum cylinder.

The piston of the small motor or engine is connected by a rod to a crank-shaft, and when at work the air from the exhaust passes into the vacuum cylinder. This air, after accumulating to a certain extent, is forced out at the top by the explosion acting under the piston and driving it to the top, thereby creating a partial vacuum, into which the exhaust air from the small motor

again enters. The deep piston in the vacuum cylinder descending by its own weight forces out the waste gases through another opening in the valves, until it touches the buffer or rod at the bottom of the cylinder, which again raises the piston above the air and gas passage to enable another explosion to take place, and so on continuously.

2829.—STEVENS, T., Berwick, "*Improvements in the treatment or purification of the waste liquids discharged from paper-mills and other works, as well as the sewage of towns, and in the modes and means employed therefor.*" Provisional protection only obtained. Dated Aug. 11, 1875.

This invention consists in purifying or defecating the discharge waters from mills and other works, as well as the sewage of towns, by charging into the water or sewage pipes a constant stream of sulphate of lime and chloride of sodium, which, with the addition of some milk of lime, all flow together through a wheel at the outlet end of the pipe, and become thoroughly mixed before being discharged into and flowing through tanks of three compartments wherein the matters held in suspension are deposited, the effluent water flowing off from the third compartment through a filter. The precipitated matter is pumped out at intervals, and, being mixed with more sulphate of lime, is converted into a manure.

2842.—SUGG, W. T., Vincent Works, Westminster, "*Improvements in apparatus for the storeage and supply of gas.*" Patent dated Aug. 12, 1875.

These improvements have for their object the more facile, convenient, and safe storeage and supply of gas to railway, tramway, and other similar carriages, and consist—1. In the construction of the hose or flexible pipes used to convey the gas from the main to the gasholder. 2. In forming the joints of the collapsible holder. 3. In making small flexible tubes suitable for attachment to ordinary gas fittings.

The hose is formed by wrapping a hollow coil of wire, wound into a spiral, with leather dressed without oil or other grease. The flesh side of this leather is put outside, and the surface is coated with a solution of india-rubber, and upon and around the leather so coated is placed unvulcanized sheet-rubber, rubbed and pressed until it closely adheres to the leather. Another layer of leather is then coated with india-rubber solution and applied outside the sheet-rubber, when the whole is pressed and rubbed so as to exclude air and ensure the thorough junction of the surfaces. When necessary one or more layers of sheet-rubber and leather may be added to ensure greater security and strength, the joining of the surfaces being the same as already described.

The gasholders are constructed in shape very much like the common accordion bellows, but by preference principally of wood, the flexible portions being made of two layers of leather dressed without oil, and coated on the flesh side with solution of india-rubber. Unvulcanized sheet india-rubber is then inserted between the leather, and the whole either rolled or pressed to ensure perfect contact of the surfaces. In this case also the substance may be thickened by additional layers of rubber and leather treated as mentioned.

2843.—ANDERSON, G., Cannon Row, Westminster, "*Improvements in apparatus for the more economical manufacture and supply of illuminating gas.*" Patent dated Aug. 12, 1875.

These improvements consist—1. In the building of retort-houses in such a manner that they will occupy a smaller space, and therefore cost less in construction, while they permit more work being done within them, and afford increased facilities for ventilation. This is done by increasing the width and reducing the length of the retort-house, and by setting the retorts in rows parallel to each other, instead of in one continuous line, as is now usually done. The roof, instead of being made in one span, is constructed with a number of ridges and supported by columns. By these means the amount of brickwork and the weight of the roof may be considerably reduced, while the space enclosed may be more advantageously employed than usual.

2. In the construction of the condensers, which may be either of pipes set vertically or horizontally, but preferably the latter, and providing them with valves so arranged that one, two, three, or more portions of the apparatus may be employed at one time, so as to allow of the gas being retained in the condenser and exposed to an increased or decreased surface, in proportion to the temperature of the atmosphere. This part of the apparatus, too, from its arrangement, may be also constructed with great economy.

3. In the construction of washers, each of which is made with a high rectangular iron case, in which two, three, or more semicircular partitions are fixed. Through the centre of each semicircle is fitted a shaft which carries arms for the support of a drum with a circular brush-like appendage made of split whalebone or other like material, and so fitting the interior of the semi-cylinder as to offer little or no impediment to its free revolution. Water or other liquid is admitted from above, and descends into the top compartment to such a height as will cover the lower part of the circular brush, the excess of liquid passing to the next lower compartment, and so on throughout the series, the height of liquid in each vessel being regulated by the position of the pipe communicating with the adjoining chamber. The gas is admitted at the bottom, and passes through a short horizontal washer or chamber into the lower compartment, when, upon motion being imparted to the shaft, the gas is broken up into innumerable streams, washed by contact with the wet brush, and swept on to the outlet, from whence it flows to the inlet of the next upper chamber, there to be operated upon in the like manner, and so on till it reaches the top outlet. This is an arrangement which absorbs but little power to drive it, and consequently it can be put in operation at but small cost.

4. In the construction of wet purifiers. This is done by forming a shallow circular covered vessel, and admitting gas to it near the bottom, where it passes by numerous holes round the interior circumference through liquid to the centre of the purifier. Here the gas rises, passes through another plate and further liquid, this process being continued till it reaches the outlet at the top, from whence it passes to the dry purifiers.

5. In the construction of dry purifiers which are quadrangular in front elevation, but in transverse vertical section are of a rhomboidal form. The vessel or chamber is divided into a number of compartments, each fitted with many trays or grids to receive the purifying material, and lying at such an inclination as to permit of the material being raked out, through doors provided for the purpose in front of the purifiers, whenever it becomes necessary to discharge the vessel. Doors on the opposite side are also furnished, through which the vessel may be charged with fresh material. Connexions and valves are also provided, by which the gas may be sent through one, two, three, or more of the divisions or compartments, according to the condition of the material therein. There is another form of dry purifier, which it is preferred to make of either iron, brick, or stone, and either built upon, or partly above and partly below the surface of the ground. They are made by preference circular, although they may be polygonal or any convenient shape. They are built, however, of a greatly increased depth, so as to admit of a far larger number of grids, and contain a great deal more purifying material than purifiers of the same area ordinarily do. Provision is made by one arrangement for the admission of the gas at one or more of three points, according to the condition of the material therein, and a suitable outlet is also provided for the gas. In another arrangement the pipes are so ordered that the gas may be admitted both at the top and bottom of the vessel at the same time, the gas passing off at an outlet placed in the middle of the side of the vessel. The removable cover instead of occupying the whole area of the purifier, is reduced to such size only as will allow of the vessel being discharged with facility.

6. In the construction of purifier-houses suitable for the enclosure of the dry purifiers described in the previous paragraph. They may be built of brick, masonry, concrete, or any suitable material, of a shape preferably the same as the purifier, but of much larger area. The building has a roof which is furnished with both dormer windows and one or more ventilators. The sides of the building also have openings which may be fitted with storm windows, so as to be closed or open as occasion may require. There are also stages or galleries erected round the outside of the house, from which access may be obtained to the interior. Between the purifier and the inside of the building and at convenient heights are fixed several series of radial girders, set at an inclination either to or from the purifier. The spaces between the girders are filled in with arches so as to form a series of inclined floors; upon which the purifying material (supposing it is oxide of iron) may be placed for revivification, spaces being left whereby the material may be conveyed from one floor to another, or to the bottom when necessary. At the top of the purifier, and between it and the surrounding walls, is placed a short railway, which is free to revolve round the purifier, and upon the railway is a small suitably shaped waggon made to tip or otherwise be discharged, so that when the purifier is to be emptied the material is hoisted, put in the waggon, run along the railway, and then shot out on to any of the floors selected; or the waggon itself may be so contrived as to be adapted for being lowered into the purifier and to be subsequently hoisted and used as before described. As the material becomes renovated, it is raked either into the purifier through openings, made for the purpose, or is allowed to fall to the bottom outside the purifier, and when sufficient is collected the purifier may be re-charged by lowering the waggon, filling, hoisting, running it along the railway, and emptying it into the vessel upon the gride, where it may be spread in layers of the requisite thickness.

By the adoption of these various means, space and expenditure of material may be greatly diminished, thereby decreasing the capital to be employed, while from the arrangement of the different parts, manual labour is so considerably reduced that gas produced through the agency of these improvements may be supplied far more economically than has hitherto been generally the practice.

2856.—BUTLER, G, Southwark, Surrey, "*Improvements in ball valves for high or low pressure water service, and for drawing off other liquids.*" Patent dated Aug. 13, 1875.

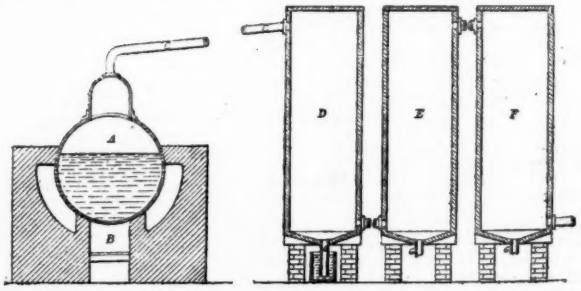
This improved valve is constructed in the following manner:—There is cast a hollow casing, or valve-box, open at each end and at one side, the side opening terminating with an external screw-thread, for connexion to the service branch; the two other openings are at opposite ends, and within them works the valve. In the lower part of the casing, and beneath the service branch, is a circular-faced seating, on which rests the valve. In the top of the opening is screwed a cap, which acts as a stop for the valve, and also may be removed when required to take out the valve for renewing the packing. The spindle is in two pieces, the upper part terminating at its upper end with a head, or prolonged spindle, to act as a guide, and at the lower end with a washer, to receive the packing. The lower piece terminates, at its top end, with a screw and washer, for attachment to the upper piece, and to clip the packing between them. The lower part of the spindle is spread out to form two ears; between them is passed the ball lever, attached to them by a pin, while from the lower part of the casing project two ears, to carry the fulcrum pin of the lever. The ball at the outer end of the lever is weighted to ensure its falling when there is no pressure of water against the under side, so that when the ball falls through want of water it lifts the valve, and allows of the admission of water until the tank is filled, when the ball rises, and draws the valve down on its seating. The pressure of the water then being on the top of the valve, the packing is pressed tightly down on to its seating, and no leakage can possibly occur.

2880.—PATERSON, R. O., and BROTHERS, F. W., Cheltenham, "*Improvements in obtaining salts of ammonia.*" Patent dated Aug. 16, 1875.

This invention has for its object the more ready and economical means of obtaining a carbonate or the carbonates of ammonia from the ordinary ammoniacal liquor resulting from the distillation of coal and other similar material in the manufacture of gas, or from other ammoniacal solutions, and consists in the following process:—The ammoniacal liquor is run into a boiler, from which a pipe of suitable capacity rises, and is continued to any convenient length. It is then caused to enter a chamber or receiver, furnished with means for draining off any liquid that may collect in it. To this receiver one end of another pipe rises, the other end being attached to a second receiver. To the second receiver there is also a pipe communicating with a third receiver, and so on until there is a sufficient number of them. Heat is then applied to the boiler, and the ammoniacal liquor is raised in temperature sufficient to disengage the ammonia and carbonic acid contained therein, the gases and vapours passing up the first-mentioned pipe, which should be of such a length and capacity, or subjected to such cooling influence, and so arranged as regards inclination, that, while the gases will pass on into the receiver, the aqueous vapour shall be condensed and fall back into the boiler. By these means the carbonic acid and the ammonia will be disengaged and deposited in the receiver in the form of a carbonate or carbonates of ammonia, while the sulphuretted hydrogen or other sulphurous gases will pass on to the outlet of the last receiver, where they may be arrested by lime or oxide of iron, or otherwise disposed of.

The bulk of the carbonate of ammonia will be deposited in the first receiver; but in order to avoid loss of ammonia, a second and third, or even more receivers may be added if found requisite, and instead of only one pipe being used for the conveyance of the gases and vapours, any convenient number may be employed.

At times it may be found that the ammoniacal liquor does not contain sufficient carbonic acid to neutralize the whole of the ammonia, and in that case it will be necessary to supply an addition of carbonic acid, to be obtained by the decomposition of chalk or by other well-known means.



In the illustration, A represents a boiler set over a furnace, B. From the top of the boiler rises a pipe, C, communicating with the receiver, D. This pipe is made of such length, or subject to such cooling influence, as will ensure the condensation of the aqueous vapour, and is placed at such an inclination as to cause the condensation to flow back into the boiler. E and F are two additional receivers in communication with D, and are used for the purpose of catching any ammonia that may escape from D uncondensed; G, G, G are pipes for leading away any liquid that may be formed in the receivers.

2884.—WIRTH, F., Frankfort-on-the-Main, "*Improvements in water-meters.*" A communication. Patent dated Aug. 16, 1875.

These water-meters are distinguished from others in the following particulars:—

1. The driving wheel, which is moved by the water, and the number of

rotations of which correspond with the measuring dial, is different from all other driving wheels of the kind, in that it is provided with an inner division as well as with horizontal partitions attached above and below, which serve for the purpose, and give to the water a certain and constant cross sectional motion, so that when flowing through with varying velocity, it is always in exact proportion to the number of rotations marked on the dial. This has been thoroughly proved by a number of experiments.

2. From the time it enters till it flows from the meter, the water is kept in a horizontal plane, whereby impurities cannot be deposited, and the inserting of these meters in the mains is greatly facilitated. This can only be attained with other meters by the water being again raised to the horizontal level of the mains by means of a vertical tube.

3. The water exercises on the small wheel, which serves for measuring, and is moved by the water, only a lateral pressure, and as hereby the pressure rests similarly on both sides of the periphery, no lateral friction is produced on the axis of the wheel. Pressure in a vertical sense does not exist, and hence there is only friction at the lower pivot of the axis, which is produced by the weight of the small wheel, which is so small that the loss by friction can be altogether disregarded. Hence the water has only to overcome one resistance in its passage through the meter—namely, the momentum of the registering hand and wheels.

4. With regard to the construction, the following is new and peculiar:—In order that the water passing through the meter may be conveyed in equal quantities against the common horizontal planes, the two inlet channels are of exactly the same dimensions, and the channel for the outflow of the water is passed through the lower inlet channel. The works which transfer the rotations of the driving wheel to the counting mechanism are much simplified in being constructed upon the head piece. The technical difficulties which presented themselves in manufacturing the body of the meter, especially in casting the channels, are obviated in that the interior division wall is not necessary, as it is replaced by a shell in the shape of a ring, in which the slits for the entrance and egress of the water are easily made.

2888.—PACKER, O., Westminster, "*Improvements in double-slide box-cocks.*" Patent dated Aug. 17, 1875.

According to these improvements the box-cock consists of three metal cases fitting inside each other, the two internal ones moving up and down by means of a screw, and thereby reducing or increasing the flow of the water or other liquid, which passes through orifices provided for this purpose in the top of the two external cases at pleasure.

2905.—DUCKHAM, H. A. F., Holloway, Middlesex, "*Improvements in gas regulators, more especially applicable for regulating the supply of gas to the burners of railway and tram carriages.*" Patent dated Aug. 18, 1875.

This invention mainly consists in the use of a reservoir of air (as in the guard's van), and which is forced by a pump or other means into tubing, so as to inflate a chamber with a flexible diaphragm, which is thereby raised and drives a valve into its seat in an outlet-pipe. This prevents the gas flowing to the burners, with the exception of only a sufficient quantity to prevent its going entirely out, so that the pressure upon the air reservoir being released by the guard or attendant, the pressure of the gas in the regulator will at once act upon the diaphragm of the chamber, open the valve to the outlet-pipe, and allow the lights to burn with their proper brilliancy, either in passing through a tunnel or at nightfall. The lowering or raising of the light is perfectly under control, and does not require any attention, except such as is necessary for raising or lowering it.

2930.—STEEL, J., Glasgow, "*Improvements in drawing retorts, and in the machinery or apparatus employed therefor.*" Provisional protection only obtained. Dated Aug. 20, 1875.

This invention consists under one modification of a tube or hollow rake, to one end of which a flexible pipe communicating with a steam-boiler is secured. The opposite end is bent downwards, and formed with one or more holes or openings made parallel with or at an angle to the length of the tube. When it is desired to withdraw the charge from the retort, the bent end of the tube or rake is pushed through the retort mouth. A cock or valve is then opened, so as to admit steam, which, on issuing through the holes or openings in the bent portion of the tube, blows or forces the charge of material out of the retort through the open mouth.

A shield may be fitted to the front of the retort to protect the operator, and to guide the disharged materials into the hutch or waggon placed to receive them, and a carriage may also be provided, if desired, on which to support the tube and its connexions, which are capable of being raised and lowered to the level of any retort in a bench.

The boiler in which the steam employed in the apparatus is generated may either be a fixed boiler, in which case it may conveniently derive its heat from the heated waste products of combustion passing through the flues of the retort setting, or it may be a moveable boiler, and mounted on a carriage or truck.

Under another modification the tube or hollow rake is dispensed with, and the flexible pipe is provided with a cock or valve, and with a nozzle, through which the steam passes into the retort to blow or force out the charge. In accordance with this arrangement an opening is made in the rear end of the retort to receive the nozzle, which opening, when the retort is in operation, is closed by a stopper or plug, luted with clay or other material to prevent escape of gas. When the charge is to be withdrawn, the stopper or plug is removed, and the nozzle inserted; the door at the retort mouth is then opened, and steam being conducted through the nozzle, the charge is forced out through the retort mouth.

In lieu of employing steam in connexion with either of the forms of apparatus, compressed air may be used.

2989.—DUBOIS, J. L., Clapham, Surrey, "*Improvements in cocks or taps.*" Provisional protection only obtained. Dated Aug. 26, 1875.

These improvements have reference to that class of cocks or taps in which valves are used, and the object is to secure increased efficiency in use. Accordingly, the spindle of the valve is acted upon for the opening by a scroll-formed cam, turning upon a fixed axis, and operated by a lever-arm, mitre or other tooth gear, or other suitable means. This scroll is formed so that its shortest radius is greater than the increase thereof for the motion to be obtained, and in place of acting directly on the upper part of the spindle of the valve, it acts upon a rocking piece, the surface of which is extended, and is of form corresponding with that of the scroll, so as to obtain sufficient holding for readily retaining the valve at any extent of partial opening. The upper end of the spindle, or the guides thereof acted upon by the scroll, may be of corresponding shape and extent of surface, or have rollers thereto of like correspondence. The valves may be acted upon to close with or against the flow of the fluid, and a spring employed, if desired, to aid the closing.

2994.—BEACH, H., Brighton, "*Improvements in taps known as high-pressure water taps.*" Patent dated Aug. 26, 1875.

The chief object of this invention is to prevent the necessity of water companies turning off the water from the mains during alterations or repairs to the internal fittings or to the repair of the tap itself, thus saving considerable labour and expense and preventing great waste of water, while at the same time a full water-way can be always obtained.

The invention consists in the application to the lower part of high-pressure water taps of a mushroom or other valve on a screw spindle, working through a stuffing-box in such manner that the valve can be raised or lowered as required. When the tap is fitted and in use, under ordinary circumstances the mushroom valve is down, so that water may freely pass; but in the event of the tap being out of order, the valve can be raised to its seating, and the water thereby prevented from passing through the tap, when the leathers of the tap may be taken out, or the tap otherwise repaired as may be required.

3010.—BONNEVILLE, H. A., Paris, "*Improvements in the manufacture of gas for lighting and heating, and in the apparatus connected therewith.*" A communication. Patent dated Aug. 27, 1875.

This invention relates to a process of manufacturing gas from hydrocarburets, and to a retort and injector to carry the process into effect, and consists substantially in causing the hydrocarburet vapours to pass through a sufficiently heated metal bath. For this purpose it is poured into a tank, which is then hermetically closed. The top and bottom of the tank are, by means of pipes, connected with the retort in which the gas is made, so that the pressure in the retort is equally felt above and below the liquid in the tank in such a manner that the flowing of the liquid from the tank into the retort takes place by the simple action of its own weight. The retort standing vertically is filled up to a certain height with any suitable metal (such as lead, for instance), into which dips the inlet-pipe of the hydrocarburet. The latter, in falling upon the red-hot metal, becomes vapour, and compresses the metal to the lower end of the pipe. The vapours engendered escape through apertures in this lower end, penetrate while ascending the mass of melted metal, become decomposed, and reach the upper part of the retort, from whence they flow through pipes into the apparatuses generally used for manufacturing gas.

3019.—WEYHE, W., Bremen, Germany, "*Improvements in motor engines worked by steam, air, gas, or other fluid, also partly applicable as pumps or blowing-engines.*" Provisional protection only obtained. Dated Aug. 27, 1875.

According to this invention, a cylindrical piston is caused, by fluid pressure, to revolve in an annular passage, formed by bolting face to face two discs, having semi-circular recesses round their peripheries, and which constitute the casing of the engine. Between the central parts of the two discs is placed another disc, fixed on a shaft passing through the casing; to this disc is fixed the piston, the rotation of which consequently causes the disc and shaft to revolve. At one point of the annular passage, a slide is made to project, so as to act as a division, and on one side of the slide is the inlet port for fluid pressure, while an escape port is provided on the other side. The piston has a beak, or incline, which, as it passes round in the passage, pushes up the slide so as to allow the piston to pass through the slide, closing again by the action of a spring. Arrangements of pipes and heating and cooling apparatus are described in conjunction with a duplicate engine to adapt it as a caloric engine, the one engine acting as a pump. A modification of the engine is also described for adapting it to be worked by explosive mixtures of gas and air.

3048.—GOSLING, L., Kilburn, and GLUCKSTEIN, L., Westbourne Park, Middlesex, "*Improvements in apparatus for lighting gaseliers or street-lamps.*" Provisional protection only obtained. Dated Aug. 31, 1875.

This apparatus, for the purpose of lighting gas, is constructed of graphite or platinum plates as negative elements, contained in either a circular or other suitable graphite chamber or bottle, the outside of which is rendered impervious to the exciting solution by the application of gutta-percha or other suitable material. The conducting-wires are covered by a gutta-percha or other suitable insulator, inside a cane or stick of a suitable length for lighting ordinary gaseliers, street-lamps, &c. The ends of the conductors are connected to a coil of very fine platinum wire, the incandescence of which ignites the gas at the moment the zinc is brought into contact with the exciting liquid, by the application of the thumb to a wire or spring trigger.

3070.—LAKE, W. R., Southampton Buildings, London, "*Improvements in liquid meters, which may also be used as pumps or motor-engines.*" A communication. Patent dated Sept. 1, 1875.

These improvements relate to an apparatus for measuring liquids, and capable also of being used as a pump or as a motor engine, consisting of a close cylindrical chamber provided with an inlet for the admission of the stream or liquid, and an outlet for the discharge of the contents of the cylinder. Three radial blades are mounted, so as to revolve around the common central axis of the cylinder within the chamber. A driving shaft is combined with the blades, whereby the blades revolve severally in the same times, but relatively to each other at different rates of speed, so that each shall act successively as a plunger when the apparatus is used as a pump or meter, or act as a wheel float when the apparatus is used as an engine, and as a diaphragm to separate the incoming stream from the outflowing discharge.

3102.—CARTER, H., Manchester, "*Improvements in gas-fittings and burners.*" Provisional protection only obtained. Dated Sept. 4, 1875.

This invention relates in the first place to ordinary water-slide gaseliers, and has for its object to lessen the liability to accidents arising from the escape of gas resulting from a deficiency of water in the tubular shafts. The cup or upper end of the shaft containing the water is fitted with a cover, which is formed with a stuffing-box, sliding on the pendant tube; a whistle or double whistle is fixed on this cover, or on the upper end of the shaft, so that any gas escaping through the water issues through the whistle and sounds an alarm.

The second part of the invention relates to gaseliers or lights which are fitted with reflectors. In these, brackets fitted with burners are arranged around a silvered glass reflector, of a globular form, the gas-pipes passing through orifices in the reflector to the brackets, and a horizontal concave reflector is arranged above the globular reflector.

The remaining part of the invention relates to burners, and consists in electroplating them with gold, silver, or other suitable metal, and also in fixing a square or cubical piece of earthenware in the interior of each, in order to contract the passage for the flow of gas, and thereby to effect economy in the consumption.

3137.—YOUNG, W., Clippens, N.B., "*Improvements in obtaining hydrocarbon vapours from gases, and in the apparatus employed therefor.*" Patent dated Sept. 7, 1875.

This invention has for its object the more perfect removal and collecting of those hydrocarbons diffused through the gases produced in obtaining mineral oils from coal, shale, and analogous bituminous substances, as well as in the processes of coking coal, and consists of an improved arrangement whereby the large quantity of oil necessary to absorb the hydrocarbon vapours from the gas is economically applied, and thereafter treated for the recovery of the absorbed volatile liquids.

The invention further relates to an improved means of lessening the quantity of oil required to absorb and remove the vapours of the volatile hydrocarbons in the gas.

[In a future number we shall give the details of the apparatus and means employed.]

3179.—WISE, W. L., Adelphi, London, "*Improvements in apparatus for purifying illuminating gas.*" A communication. Provisional protection only obtained. Dated Sept. 10, 1875.

The object of this invention is to purify illuminating gas produced from coal, and consists of certain combinations of mechanical devices, by means of which the gas is forced through and brought into intimate contact with one or more purifying liquids, and freed from tar and other liquid impurities.

In one arrangement the gas is introduced by a pipe into a hollow head, whence it passes down a tubular shaft, and is rapidly discharged by a centrifugal wheel, which thus forces it into the purifying liquid. As the gas rises it is agitated with the purifying liquid by means of perforated diaphragms, and on leaving the upper end of the chamber it collects in a cavity at the under side of a double bell-formed centrifugal wheel, and enters the hollow interior of that wheel

through perforations that form an eye for it. The gentle centrifugal action of this wheel discharges the gas through a second purifying chamber, in which it is subjected to the action of a second purifying liquor. Finally the purified gas escapes through a pipe provided for the purpose.

The purifying liquid which it is preferred to use in the first or inner purifying chamber is either chloride of calcium, chloride of manganese, chloride of magnesium, or milk of lime, but any other suitable purifying liquid may be used.

Sponge moistened with water alone may be used, or moistened sponge may be used as a support for pulverulent solid purifying matter, such as hydrate of lime, or hydrated or spongy oxide of iron.

The peculiar cellular structure of the sponge is of great advantage, as it presents an immense purifying surface to the gas in the second purifying chamber, and causes it to travel in tortuous channels.

The gas is thus forced through the purifying liquid by centrifugal action in the same apparatus in which the purifying liquid is contained, so that the necessity for the employment of a gas exhauster or other gas-forcing mechanism is obviated. The gas is thoroughly agitated with the purifying liquid by the action of the revolving diaphragms in the purifying chamber, and being subdivided into minute bubbles, is brought into intimate contact with the liquid. The gas is then subjected to the action of the second purifying liquid contained in the second purifying chamber, through which it is forced (notwithstanding the resistance of the purifying liquid) by the centrifugal action due to the moderate revolution of a second centrifugal wheel.

As the gas is discharged into the well at the bottom of the second purifying chamber, it is thrown off tangentially, and whatever particles of tarry or ammoniacal liquid matter are mechanically carried with it from the first purifying chamber are thrown against the wall of the well while the gas rises. Consequently these liquid impurities flow down by gravitation to the bottom of the well, and the gas is freed from them before being subjected to the second purifying material. The liquid particles thus collected may be permitted to flow from the bottom of the well by a syphon drain-pipe fitted to a hole in its bottom.

3205.—SPENCER, W. H., Brooklyn, U.S.A. "*Improvements in the manufacture of illuminating gas.*" Patent dated Sept. 13, 1875.

In these improvements a retort, preferably of iron, lined with lime is employed, and near one end is introduced a jet of oxyhydrogen gas, the relative quantities of it being regulated so that the flame will be similar to the oxyhydrogen blowpipe, and the result the production of watery vapour. Into this retort hydrocarbon, either in the form of petroleum oil or olefiant gas rich in carbon, is introduced and the great heat produces a decomposition and recomposition resulting in the formation of illuminating gas or a diluent therefor. Aqueous vapours may also be admitted, which in addition to those from the combustion of oxygen and hydrogen serve to dilute the hydrocarbon gas generated by supplying hydrogen from the decomposition of the water. By these improvements the gas generating apparatus is rendered almost automatic, because so long as the respective gases and the hydrocarbon are supplied in regulated quantities, the process will continue, and the gas produced will require but little purifying. The pressure in the retort can be maintained sufficient to force the gas into the holder, thereby dispensing with a considerable part of the intermediate apparatus now usually employed.

The oxygen and hydrogen employed are to be obtained in any desired manner and burned together in the proper proportions as usual. According to the well-defined figures of analysis, the combustion (approximately) of 1000 cubic feet of oxygen with 2000 cubic feet of hydrogen is equivalent to the production of 100 lbs. of water, which would require the carbon of about six gallons of oil for its decomposition, returning the 2000 cubic feet of hydrogen originally employed, *plus* 1000 feet due to the hydrocarbon, and 1000 feet of carbonic acid, while the excess of heat, over and above that necessary to effect the decomposition, is left applicable to the decomposition of an additional quantity of hydrocarbon and steam introduced by the same jet as the original hydrocarbon; additional heat at the same time being generated by the combination of the oxygen and carbon, the total heat of the flame therefore being used in raising the material from atmospheric temperature to a point at which dissociation takes place.

3220.—WHITAKER, J. W., Wakefield, "*Improvements in apparatus for charging gas-retorts.*" Patent dated Sept. 15, 1875.

This invention has for its object the reduction of manual labour, and consequent economy in the charging of gas-retorts, and consists of a cradle or moveable stand, whereon the scoop is placed for filling. The scoop itself is very similar to that now ordinarily employed, but is provided, if thought desirable, with rollers at the bottom, to assist in introducing it to the retort with greater ease. In front of the retort-benches, and either depending from the roof, or supported by the retort-house walls, or other suitable manner, is constructed a light railway, upon which a traveller is free to run from end to end of the retort-house. This traveller has fixed to it a bar parallel to the axis of its wheels, and upon it runs a grooved wheel or pulley, from which hangs a rod or bar forked also at its lower extremity, so as to receive and form a fulcrum for a lever pivotted thereto. To the short end of the lever is jointed a rod, which is connected by means of a swivel to a hoop made to embrace the scoop, the other or long end of the lever being furnished with a rope or chain.

The application of the apparatus is as follows:—The cradle whereon stands the scoop is placed near the retort to be charged; the scoop is now filled, and the traveller roughly adjusted to its proper position. The rod depending from the short end of the lever is made to engage in the hoop, and while one man takes hold of the cross-handle of the scoop, another pulls upon the long end of the lever, thus raising the scoop to the desired level; the man at the handle then thrusts the scoop so hung into the retort, turns, and withdraws it with the greatest ease, the man at the lever lowering it into the cradle ready for the repetition of the operation. By these means one-third of the labour employed in this particular work may be saved, and with less exertion to those occupied.

APPLICATIONS FOR LETTERS PATENT.

3620.—BOULTON, M. P. W., Tew Park, Oxford, "Improvements in engines worked by the combustion and expansion force of an inflammable fluid mixture." Sept. 15, 1876.

3655.—FOULIS, W., Glasgow, "A new or improved gas-governor." Sept. 19, 1876.

3656.—WILKINS, S. B., Edinburgh, "Improvements in ball-cock hydrants." Sept. 19, 1876.

3674.—HARRIS, R., Bow, London, "Improvements in the purification of gas." Sept. 20, 1876.

3692.—GODFREY, S., and HOWSON, R., Middlesbrough-on-Tees, York, "Improvements applicable to gas-furnaces, and in the utilization of gas-furnaces." Sept. 21, 1876.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1230.—M'JANNET, J., Greenock, N.B., "A new or improved ball-cock." March 22, 1876.

1256.—LAKE, W. R., Southampton Buildings, London, "Improved combustible compounds, and apparatus for the production of gas for domestic, manufacturing, military, and other purposes." A communication. March 24, 1876.

1264.—LAWRENCE, P., Blackfriars Road, London, "Improvements in gas and other stoves." March 24, 1876.

2166.—ORTMANS, V. C. J., Brussels, "An improved rotatory pump or apparatus for raising and forcing fluids, and for other purposes." May 22, 1876.

2758.—LEWTAS, J., Manchester, "Improvements in apparatus for lighting, heating, and cooking purposes." July 6, 1876.

2824.—LINFORD, C., Leicester, "Improvements in gas-engines, and in appliances connected therewith." July 11, 1876.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

2994.—CLARKE, A. M., "Improvements in screw-valves." Sept. 11, 1873.

3005.—VALON, W. A. M., "Improvements in apparatus to be used in the manufacture of gas." Sept. 13, 1873.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

GWYNNE & BEALE'S PATENT IMPROVED GAS-EXHAUSTERS,

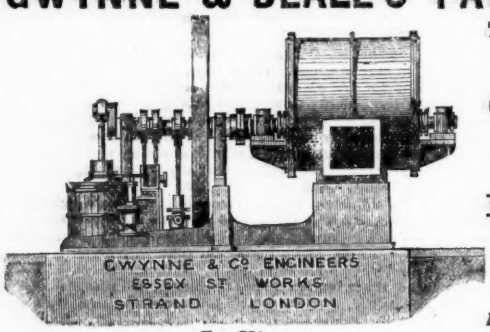


FIG. 224.

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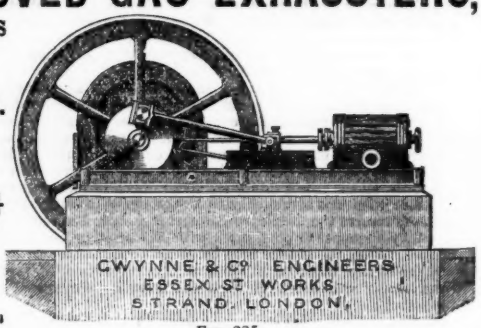

FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND CO. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,
CAN BE HAD ON APPLICATION TO
GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

G. & Co. are now manufacturing for a London Gas Company three of their 210,000 cubic feet Patent Gas Exhausters, and many of all sizes.

D. BRUCE PEEBLES & CO.,
ENGINEERS,
FOUNTAINBRIDGE WORKS, EDINBURGH,
MANUFACTURERS OF **WET AND DRY GAS-METERS;**
Patentees and Sole Manufacturers of PEEBLES' LAMP-GOVERNORS,
ABOVE 30,000 OF WHICH ARE NOW IN USE.

"These Lamp-Governors are so superior that they are likely to supplant all others."—*Dr. Wm. Wallace, F.R.S.E., F.C.S.*

D. BRUCE PEEBLES AND CO., FOUNTAINBRIDGE WORKS, EDINBURGH.

GAS-WORKS CLAUSES AMENDMENT ACT, 1871.

ANNUAL ACCOUNTS
OF
GAS COMPANIES.

FORMS OF ANNUAL ACCOUNTS, arranged as required by the 35th Section of the Act (34 & 35 Vict., cap. 41), are now ready.

These Forms have been printed on large sheets of paper of the best quality, and are carefully ruled so as to afford the utmost facility for compliance with the provisions of the Act.

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A Specimen Sheet on receipt of Six postage stamps.

WANTED, a steady Man as Main and SERVICE LAYER, with a knowledge of meter connecting.

Address No. 304, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a first-class Fitter, for fitting up private and public buildings. Constant employment.

Address No. 305, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a steady Man, who understands laying services, blacksmith's work, taking indexes, and attending to an engine. One accustomed to small country works preferred. A suitable man will find this a permanent engagement.

Apply, immediately, to Mr. VINCENT, Manager, Gas-Works, Erith, KENT.

WANTED, a steady Man as Manager for a small Gas-Work in the country. He will have to make the gas, with assistance in winter, fix services, meters, &c. Wages 25s. per week, with house, garden, coals, and gas free.

Applications, with three recent testimonials, to be forwarded to Mr. WM. BARRATT, Gas Engineer, GRANTHAM.

WANTED, by the Hindley Local Board, a practical Man to MANAGE their Gas-Works. Annual make about 23 millions. He will be required to reside on the premises. House, rent, fire, and gas provided.

Applications to state salary required, with recent testimonials, and to be sent to the Chairman, Richard Pennington, jun., Esq., Hindley Lodge, Hindley, on or before Thursday, Oct. 5, 1876, endorsed "Application for Gas Manager."

By order,
STEPHEN HOLT, Clerk to the Local Board.
Offices, Cross Street, Hindley, Sept. 20, 1876.

AN experienced Engineer and Draughtsman desires a re-engagement as ASSISTANT GAS ENGINEER. Advertiser is thoroughly experienced in building construction, designing of gas apparatus, and gas manufacture in all its details. Excellent testimonials and references.

Address Y. E., care of Peter Scott, Esq., Maybank, Heaton Road, Withington, MANCHESTER.

ADVANTAGES OF GAS FOR

COOKING AND HEATING.

HINTS ON GAS BURNERS, &c.

By MAGNUS OHREN, A.I.C.E., F.C.S.

Specimen Copy by post Threepence, direct from MAGNUS OHREN, Gas-Works, Lower Sydenham, London, S.E.

KILDWICK PARISH GAS COMPANY.

THE Directors of this Company are desirous of engaging a suitable person as MANAGER and SECRETARY. One who has had the practical management of a Gas-Work will be preferred. His present duties will consist in superintending, as Clerk of the Works, the erection of the new works, plant, and mains, of which he would (when erected) have the charge. Duties to commence from (or before) the 1st of January next.

Applications, in own handwriting, stating experience, terms, &c., and enclosing testimonials, must be forwarded to Messrs. MILNES AND FRANCE, Architects, Cheapside, BRADFORD, on or before Saturday, the 30th of September inst.

TO BE SOLD, a bargain, a 300-light Glover's Dry GAS-METER, second-hand, as good as new.

Apply to HODGE & Co., 100, Hatton Garden, LONDON, E.C.

ON SALE—One square Station-Meter, made by West in 1866, to register 8000 feet per hour, with 8-in. valves, bye-pass, &c., now in use and in good condition.

Apply to J. AND J. BRADDOCK, Globe Meter-Works, OLDHAM.

CLEARANCE SALE.

TO ENGINEERS, BUILDERS, PLUMBERS, GAS-FITTERS, &c.

A Large quantity of Iron and Brass WORK (Cocks, Valves, and other Fittings) to be SOLD at considerably reduced prices, to effect a clearance.

For particulars apply to BECK AND COMPANY, Limited, 130, Great Suffolk Street, SOUTHWARK, S.E.

THE Swansea Gaslight Company have for immediate SALE, the following Plant:—

A 6-h.p. Patent Trunk Engine. (Beale.)
Cylindrical Egg-ended Boiler, 20 ft. by 4 ft. 6 in. (Beale.)
Exhauster to pass 15,000 feet per hour. (Beale.)
An 8-h.p. Grasshopper Engine. (Easton and Amos.)
Cylindrical Egg-ended Boiler, 20 ft. by 4 ft. 6 in. (Easton and Amos.)
Exhauster, 20,000 ft. per hour. (Beale.)
Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.
Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.
Wrought-iron Scrubber, 5 ft. diameter, 20 ft. high.
Cast-iron Scrubber, 3 ft. diameter, 20 ft. high.
A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.

May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.

Further particulars may be obtained on application to Mr. THORNTON ANDREWS, SWANSEA.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Dorchester Gas and Coke Company invite TENDERS for the purchase of the TAR and LIQUOR produced at their Works for Twelve months from the date of accepting tender.

Tenders to be delivered on or before Ten a.m. on Tuesday, the 3rd day of October next.

The Board do not bind themselves to accept the highest or any tender.

Further particulars may be obtained on application.

WM. OSMOND, Manager.

WIDNES GAS-WORKS.

THE Gas Committee of the Widnes Local Board are prepared to receive TENDERS for the supply of about 5000 tons of GAS COAL, to be delivered at their works in such quantities and at such times as may be required during the seven months from Dec. 1, 1876, to June 30, 1877.

Conditions and forms of tender may be obtained from the undersigned.

Tenders to be addressed to the Chairman of the Gas and Water Committee, endorsed "Tender for Gas Coal," and delivered at the Public Offices, Widnes, not later than Ten a.m. upon the 2nd of October.

The Committee do not bind themselves to accept the lowest or any tender.

HENRY ROBERTS.
Gas-Works, Widnes, Sept. 12, 1876.

THE Richmond (Surrey) Gas Company are prepared to receive TENDERS for their surplus TAR for One or Two years from the 13th of October next.

All particulars may be obtained on application to the Manager, Mr. Eldridge.

Tenders to be sent in not later than the 3rd of October, addressed to the Chairman, Gas-Works, Richmond, Surrey.

E. B. BLOTT, Secretary.
Richmond, Sept. 23, 1876.

KILDWICK PARISH GAS COMPANY.

TO IRONFOUNDERS.

THE Directors of the above Company are prepared to receive TENDERS for the supply and delivery of about 650 tons of CAST-IRON MAINS of various dimensions, with appendages.

The specifications and conditions of contract may be inspected, and bills of quantities, with form of tender, obtained, at our Offices, on and after Monday, the 18th inst., and sealed tenders (on the form supplied) must be delivered to us not later than Saturday, the 30th inst.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
MILNES AND FRANCE, Architects.
Cheapside, Bradford, Sept., 1876.

KILDWICK PARISH GAS COMPANY.

TO CONTRACTORS AND PIPE-LAYERS.

THE Directors of the above Company are prepared to receive TENDERS for the works requred in LAYING and JOINTING about Ten miles of Cast-Iron MAINS, with appendages.

The specifications and conditions of contract may be inspected, and further particulars, with forms of tender, obtained, at our Offices, on and after Monday, the 18th inst., and sealed tenders (on the form supplied) must be delivered to us not later than Saturday, the 30th inst.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
MILNES AND FRANCE, Architects.
Cheapside, Bradford, Sept., 1876.

PUBLIC LIGHTING.

THE Cockermouth Local Board desire to receive TENDERS for LIGHTING the STREETS of their district, either with gas or oil, from the 11th day of October, 1876, to the 15th day of April, 1877, or for such longer period as may be hereafter agreed upon.

Intending Contractors will be required to state:

1. The price per lamp per 1000 hours, for which they will provide and fix pillars or brackets, provide, light, clean, and maintain in good repair not less than 50 lamps, each lamp to give a light equal to 16 sperm candles, the number of lamps and hours to be increased at the option of the board, at the contract price, and the plant to be removed by the contractor on the termination of the contract.

2. The price per lamp as above, and the pillars, brackets, and lamps, to become the property of the board on the termination of the contract.

Specifications and conditions may be seen on application to the undersigned, to whom tenders must be sent, not later than the 3rd of October next.

JOHN FEARON,
Clerk to the Cockermouth Local Board.
Cockermouth, Sept. 21, 1876.

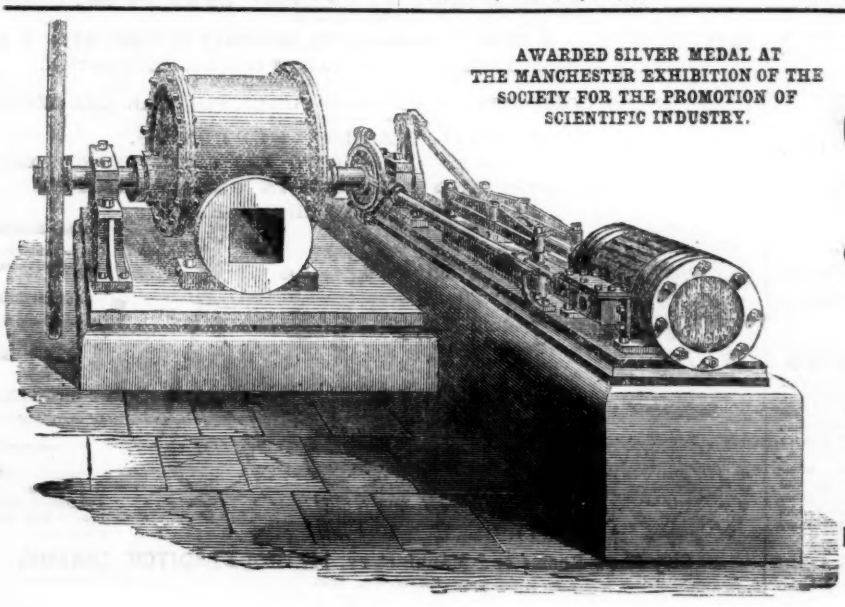
HENRY LYON,
ENGINEER,
AND
CONSULTING GAS ENGINEER,
BROOKLYN, CHEETHAM HILL ROAD,
MANCHESTER.

Mr. ALFRED LASS,
30, GRACECHURCH STREET, LONDON, E.C.,

Is prepared to open the Books, and, if necessary, keep the Accounts of Gas and Water Companies.

To examine the Books and Accounts, and prepare Balance-Sheets for the information of Directors.

To assist Secretaries in preparing Balance-Sheets, according to the "Gas-Works Clauses Act, 1871," or may be consulted with respect to Accounts generally.



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Improved Patent
GAS-EXHAUSTERS
WITH
ENGINES COMBINED.

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Makers of
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HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, and other PUMPS,
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CONDENSERS, BOILERS, &c.

PHŒNIX ENGINEERING WORKS,
HOLLAND STREET, S.E.,
AND
STROUD, GLOUCESTERSHIRE.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

THE SELF-LIGHTING GAS-BURNER.
STOCKWELL'S PATENT.
Safety, Efficiency, and Economy combined.
No Matches required.
Patentee's Sole Agent for London: J. C. KNIGHT, 96, LEADENHALL STREET.

GARSIDE'S IMPROVED MAIN DRILLING CLIP.
No. 1 takes from 2-in. to 6-in. Mains.
No. 2 takes from 6-in. to 12-in. Mains.
GARSIDE'S REGISTERED TUBE-VICE takes ⅝ brass to a 2-in. Socket.
May be had direct from the maker, SAMUEL GARSIDE, Gatefield Iron-Works, ASHTON-UNDER-LYNE.

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SLUICE VALVES AND HYDRANTS.
TO WATER COMPANIES, LOCAL BOARDS OF HEALTH, &c.

BECK AND COMPANY, Limited, having a very large stock of Sluice-Valves and Hydrants left on their hands, in consequence of a large Continental order being cancelled, are prepared to dispose of the same on very advantageous terms to immediate purchasers. The valves are from 1½ to 15 inches in diameter, of the very best material and workmanship, of the most modern designs, and proved to an hydraulic pressure of 600 feet. Prices and particulars on application.
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BAILEY'S Patented Inventions are now in extensive use wherever steam is known. Bailey's Patent Steam Gauges, Pyrometers, Water Gauge Cocks, Test Pumps, Fusible Plugs, Steam and Water Valves, Safety Valves, Junction Valves, Pumps, Tell-Tales, Recorders, Lightning Conductors, Electric Telegraphs, Turret Clocks, Steam Joint Cement, Lifting Jacks, Boiler Feeders, Lime Catcher and Separator, Injectors and Ejectors, and every description of first-class Brass Work for Engines and Boilers. Gas-Works Managers who have not our large book should send for it.

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BAILEY'S Illustrated Inventions, containing details and prices of goods in our five several departments:—(1) Brass Foundry, Steam Gauges, Indicators, Feeders, and Fittings; (2) Engineers Sundries, Small Tools, and Stores; (3) Machine Pump and Fire Engine; (4) Turret Clock, &c.; (5) Electric Telegraph, A B C Instruments, Bells, and Apparatus.
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T. NEWBIGGING,
CONSULTING GAS ENGINEER,
5, NORFOLK STREET, MANCHESTER.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

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CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers and Steam Joints.
T. BUGDEN, Manufacturer,
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Now ready, Second Edition, price 7s., by post 7s. 3d., the
GAS MANAGER'S HANDBOOK.
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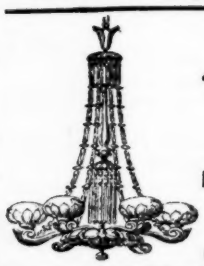
LAMP-METERS IN CAST-IRON BOXES,
And every Description of Gas Apparatus.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MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
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TABLE GLASS OF ALL KINDS.
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IRON, BRASS, COMPOSITE, AND LEAD TUBES, FOR GAS AND WATER,
AND EVERY DESCRIPTION OF
GAS AND WATER FITTINGS.
THE PATENT DRY AND WET METER, WITH THE LATEST IMPROVEMENTS.
STREET LAMPS AND COLUMNS IN GREAT VARIETY.
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GAS MOONS, Cut and Engraved, of the newest designs
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Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1876, are now complete.
City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.
ESTABLISHED 1830.

September 25th, 1876.

TO THE ENGINEERS & MANAGERS OF GAS-WORKS.

GENTLEMEN,

Circumstances necessitate our calling your attention to the characteristics of the Meter invented and patented by Messrs. WARNER and COWAN in 1874.

The drum is an OPEN WHEEL, in contradistinction to the closed annular chambers of Clegg and the curvilinear chambers of Malam, both of which were superseded by Samuel Crosley's wheel, which made the Gas-Meter an instrument suitable for practical purposes. This improvement, however, made a variable measure of each chamber, one side of which being formed by the water, the measurement varied with every variation of the water-line. Attempts were then made to maintain a uniform level. Manifold forms of fountains, scoops, and elevators, reciprocating and rotary, were employed; floats also were tried, which are but another form of elevator for raising the water; floating-wheels, too, were devised. All these, it is well known, were, with one exception—the Esson fountain—failures, varying only in degree. Thus, then, the open wheel was constructed to reduce the friction, and the compensators were applied for the purpose of obtaining correctness of measurement, by bringing back in practice an unvarying annulus through the means of a constant water-line.

In the WARNER and COWAN Meter the open wheel is still employed, ensuring freedom of action, and the gas alone is acted upon when a change of water is made. In practice the old annulus is restored, the excess of volume, arising from a lowering of the water-line, being extracted and returned to the inlet, instead of being allowed to pass away to the burners as in the ordinary Meter. THIS IS THE ESSENTIAL CHARACTERISTIC OF THEIR INVENTION, EXTRACTING WITH MATHEMATICAL PRECISION THE SURPLUS QUANTITY OF GAS PASSED BY THE COMMON PORTION OF THE WHEEL, AND RETURNING THE SAME TO THE INLET. This, too, being effected without one extra joint or moving part, thus restoring the Wet Meter to the beautiful simplicity which characterizes the original wheel of Crosley, and at the same time maintaining practical accuracy of measurement through the whole range of variations in the water-line.

In conclusion, we most heartily acknowledge the unprecedented support accorded to this invention, and remain,

Gentlemen,

Yours respectfully,

London and Edinburgh. W. & B. COWAN.

THE Vale of Neath Dinas Fire-Brick and Cement Company, Limited, Pontwalby Works, Glyn Neath, South Wales. Manufacturers of the Celebrated Genuine Dinas Fire-Bricks and Cement for Siemens's Regenerative Gas Furnaces, Bessemer Converters, Copper Smelting, Roofs of Puddling Furnaces, Glass-Works, Gas-Works, Coke Ovens, and processes involving intense and long-continued heat. Prices and estimates on application. London Agency, 11, Queen Victoria Street, City.

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SAFETY LAMP FOR GAS-WORKS,
SEWERS,
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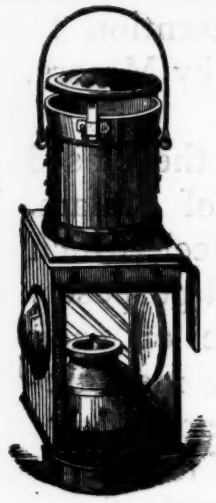

Or for any purpose where a good light and safety are required.

It has been in use over 15 years, giving entire satisfaction.

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ENGINEER, INVENTOR, & MANUFACTURER,
43, MANCHESTER ST., KING'S CROSS,
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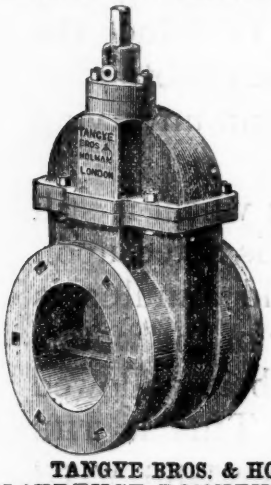
GAS-VALVES.



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LAURENCE POUNTNEY LANE,
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JAMES MILNE & SON,
GAS ENGINEERS,
Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,
EDINBURGH, AND
2, KING EDWARD STREET,
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Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,
And every description of Gas-Fittings and Gas Apparatus.

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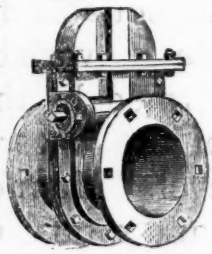
IMPROVED GAS-VALVES



WITH WROUGHT-IRON PINIONS,
List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.
These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.
VALVES MADE WITH OUTSIDE RACKS TO ORDER.
ALSO, SCREW WATER-VALVES WITH GUN-METAL FACES.
ALSO SOLE MAKERS OF
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B. DONKIN & CO.,
GENERAL ENGINEERS AND IRONFOUNDERS,
MAKERS OF STEAM-ENGINES,
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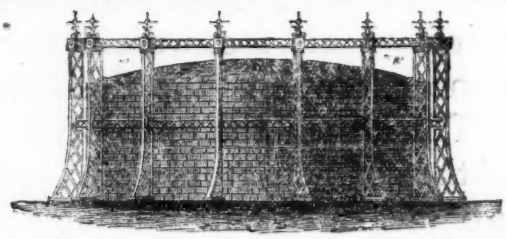
LONDON, S.E.



THE HORSELEY COMPANY,
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GAS ENGINEERS, IRONFOUNDERS, &c.,
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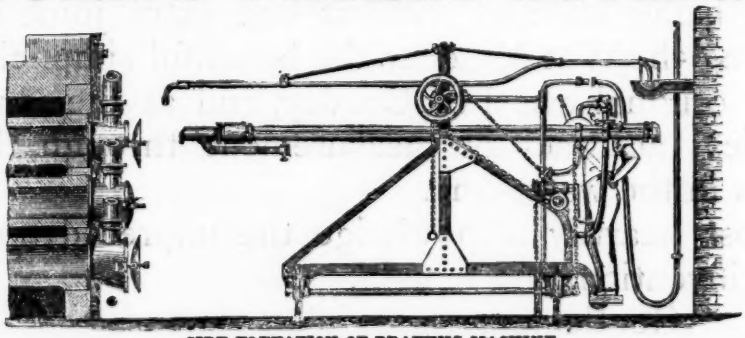
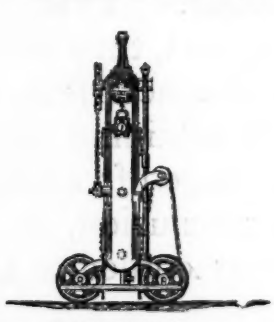
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.

FOULIS'S PATENT STOKING MACHINE.



SIDE ELEVATION OF DRAWING MACHINE.



END ELEVATION.

(*The Charging Machine will be Illustrated in next week's Advertisement.*)

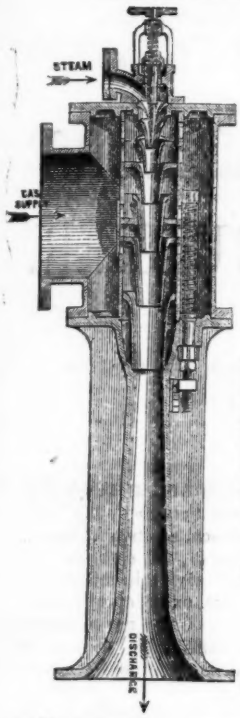
Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester; ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz:
Or all particulars may be had from JAMES WOTHERSPOON, 31, St. Vincent Place, Glasgow.

KÖRTING BROS.,

Steam-Jet Engineers,

7 and 17, LANCASTER AVENUE, MANCHESTER.

Germany: Cellerstr. 35, Hannover. Austria: Kolring., Pestalozzigasse 6, Vienna.
France: 11, Rue Louis-le-Grand, Paris. U. S.: 1645, N. 10th St., Philadelphia.



E. KÖRTING'S PATENT

STEAM-JET GAS-EXHAUSTER.

IMPROVED CLELAND'S PATENT.

Small Cost—Compactness—Perfectly Self-Acting—
Self-Regulating—Self-Cleansing—No Steam-Engine—No Attention—
No Extra Room Required—No Wear and Tear—No Noise—
No Oscillation in Vacuum, or Back Pressure.

UPWARDS OF 200 IN USE.

SUPPLIED TO—

Chartered Gas Co.	Glasgow Corporation.	Hanna, Donald, and Wilson, London.
London Gas Co.	Leyland Gas Co.	Ratcliff Gas-Works.
S. Metropolitan Gas Co.	Stalybridge Gas-Works.	Kendal Gas-Works.
Phœnix Gas Co.	Lincoln Gas-Works.	Longton Gas Co.
Liverpool Gas Co.	Birmingham Gas-Works.	Dartford Gas Co.
Bolton Corporation.	Wakefield Gas-Works.	Exeter Gas Co.
Horsham Gas Co.	Brentford Gas-Works.	Harrogate Gas Co.
Epsom and Ewell Gas Co.	Burnley Gas-Works.	Hertford Gas Co.
Ipswich Gas Co.	Guildford Gas-Works.	Waterside Gas-Works, Todmorden.
Cheltenham Gas Co.	Gloucester Gas-Works.	F. W. Grafton and Co., Accrington.
Sandwich Gas Co.	Kirkintilloch Gas-Wks.	
Cornholme Dis. Gas-Wks.	Nantwich Gas-Works.	
Bury Gas-Works.	Enniskillen Gas-Works.	
	&c., &c., &c.	

E. KÖRTING'S PATENT STEAM-JET REVIVIFYING BLOWERS FOR THE PURIFYING MATERIAL.

SOLE LICENSEES FOR

W. CLELAND'S PATENT STEAM SCRUBBER,

Combining small cost and thorough efficiency, with absence of any mechanical means and necessity of renewing the scrubbing material.

FOR PARTICULARS, APPLY TO

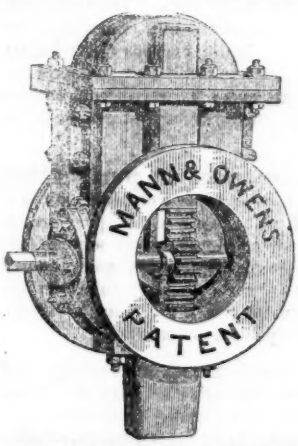
KÖRTING BROS., 7 and 17, Lancaster Avenue, MANCHESTER,

OR TO

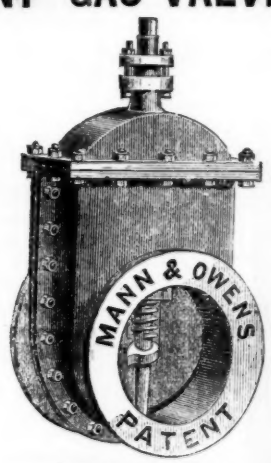
GERALD J. TUPP, 8, John Street, Adelphi, W.C., LONDON,

SOLE AGENT FOR ENGLAND AND WALES.

MANN & OWENS' PATENT GAS-VALVE.



RACK AND PINION VALVE.



SCREW VALVE.

The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.

The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifying apparatus, particularly in the case of large sizes.

The slide being operated either by a screw and nut, or by a pinion and rack, a cam bearing upon a plane, cast on the back of the Valve, forces it against the face, and renders the escape of gas an impossibility. By a slight turn of the pinion or screw, the slide is released, and brought away from the face, by which means friction is avoided, and the only force required to open the Valve is that due to its own weight.

SOLE MANUFACTURERS:

S. OWENS AND CO.,

HYDRAULIC AND GENERAL ENGINEERS,

WHITEFRIARS STREET, LONDON, E.C.

PRICES, SIZES AND FULL PARTICULARS ON APPLICATION.

INTERNATIONAL EXHIBITION, 1862.
CLASS X.
PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and
"HONOURABLE MENTION" for
good quality of Fire-Bricks.

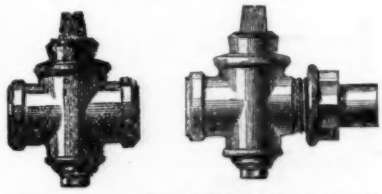
WILLIAM STEPHENSON & SONS,
THROCKLEY,
NEWCASTLE-ON-TYNE.

LAMBERT'S
CAST-IRON GAS-MAIN COCKS,

WITH PATENT WHITE METAL PLUGS.

TRADE (L) MARK.

No. 758. No. 759.



The bodies of these Taps are made of iron, black or galvanized, and the plugs of patent metal. They are warranted not to set fast or corrode, as do Iron or Brass Cocks; will always work easily; are strong, well made, durable; of little or no intrinsic value, and therefore not likely to be stolen; and the prices as stated below are (especially upon the larger sizes) fully 50 per cent. less than Brass Cocks.

	½	¾	1	1¼	1½	2-inch.
No. 758, with inside screws for iron pipe, black	2/0	3/0	4/4	6/6	7/6	12/0 each.
No. 759, with union on one end screwed inside for iron pipe, black	2/9	3/10	5/4	8/0	9/0	15/6 each.
Nos. 758 and 759, galvanized	0/3	0/4	0/6	0/8	0/10	1/4 extra.

MANUFACTORY:
SHORT STREET, LAMBETH, LONDON.

TORBAY AND DART PAINT COMPANY, LIMITED.

WORKS:
DARTMOUTH AND BRIXHAM, DEVON.
OFFICES:
23, GREAT GEORGE STREET, WESTMINSTER, LONDON, S.W.

SOLE PROPRIETORS AND MANUFACTURERS
OF
WOLSTON'S CELEBRATED

TORBAY IRON PAINTS.

(ESTABLISHED 1851.)

TRADE MARK

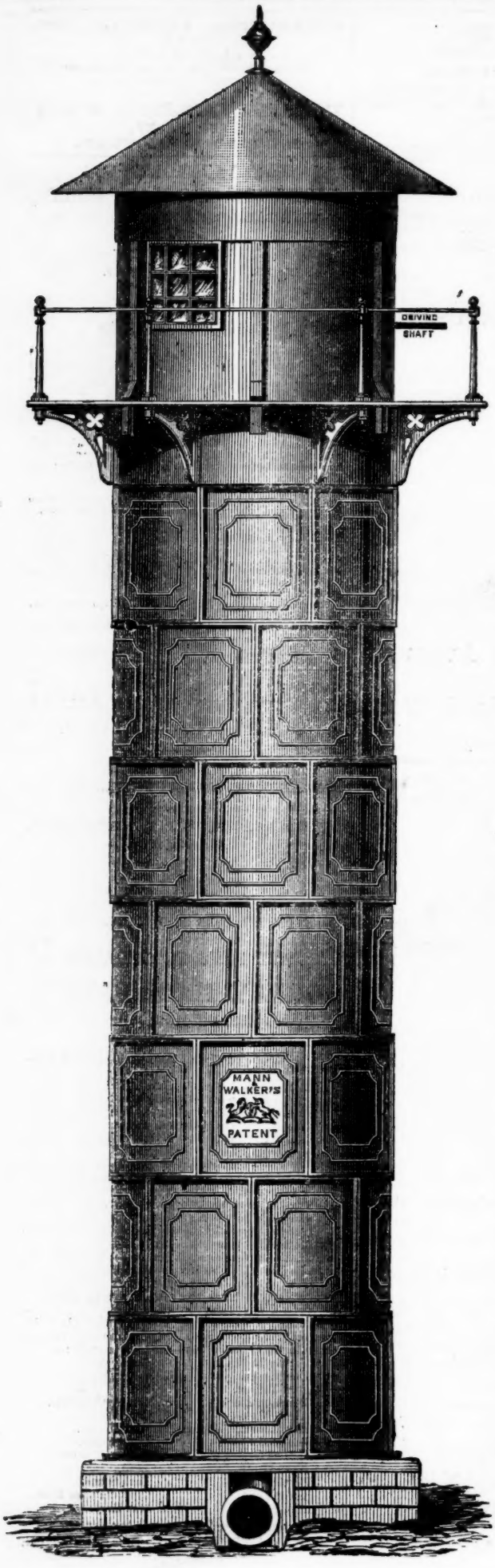
These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shorncliffe and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour, and GAS COMPANIES, Shipowners, Engineering Establishments, Railway Carriage and Waggon Works, and the Paint Trade generally. They are the BEST PROTECTORS of IRONWORK, even arresting corrosion after it has set in; and their base being oxide of iron, they are free from those properties which make lead paints so destructive to ironwork. They do not scale or blister, are not affected by great heat, and are the only Paints which will resist the effects of sulphuretted hydrogen. Their DURABILITY and covering properties have borne the test of A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

The undermentioned colours—ground in best linseed oil, and requiring only before use to be thinned down in the ordinary way—are kept in stock:—

Torbay Brown.	Torbay Red.
Dart Green.	Slate.
Dart Yellow.	Buff.
Brixham Black.	Torbay Chocolate.
Light Blue.	Cream Colour.
Dart Brown.	Dart Umber.
Imperial Stone.	Light Stone.
Bronze Green.	Salmon Colour.
Navy Green.	Lead.
Carriage Red.	Dark Stone.
Light Lead.	Crystal Palace Blue.
Light Green.	Iron Grey.

All other Colours made to order.

PRICES and TESTIMONIALS on APPLICATION.



C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im-portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

They are, in all cases, constructed under guarantees to perfectly perform their work. They are now extensively used in the largest gas-works of London and the chief cities of Europe, the number in use exceeds **one hundred,** and their perfect efficiency and profit to a gas company have been fully established with every variety of coal used in Europe. References can be given to the largest gas-works in Europe.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, re-quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

J. EDMUNDSON & CO.,

19, GREAT GEORGE STREET, WESTMINSTER,
LONDON, S.W.,

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

CONTRACTORS FOR THE

ERECTION OF GAS-WORKS, GAS-FITTINGS, &c.,

FOR TOWNS, COUNTRY MANSIONS, &c.

Estimates given free of Charge.

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

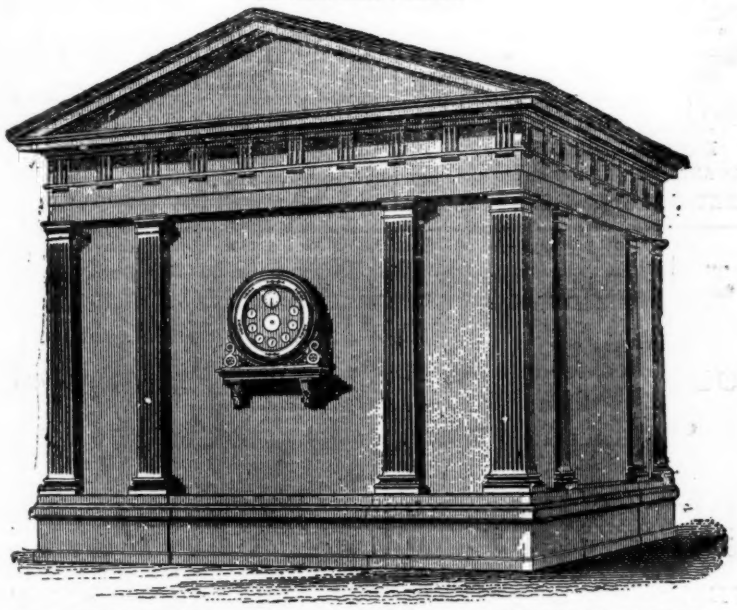
OF THE HIGHEST EXCELLENCE ONLY;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c., ON APPLICATION.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET,

WESTMINSTER, S.W.

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES.

FUEL-MACHINE, for Compressing Breeze and Tar.

WASHERS, SCRUBBERS, and PURIFIERS, that Economize Space and Cost.

N.B.—Pamphlet, with Eighteen Illustrations of the foregoing, with letterpress on the construction of Gas-Works, post free, 2s. 6d.

SCOTTISH CANNEL COAL SUPPLY AND GAS ENGINEERING ESTABLISHMENT,

EDINBURGH.

In consequence of Mr. WILLIAM ROMANS having accepted the appointment of Engineer-in-Chief to the Sheffield Gas Company, the firm of J. and W. Romans, Gas Engineers and Coal Factors, is dissolved, and Mr. John Romans, C.E., F.G.S.E., is again Sole Proprietor.

Mr. Romans, in resuming the direction of this old-established business, desires to embrace the opportunity of inviting the attention of Corporations and Gas Companies to the great importance of a skilful selection of the Cannel and Coal to be carbonized. It is a fact known to those who have patiently manipulated the distillation of gas from Cannel and other Coals, with a view to obtain the highest economic results, that by a judicious intermixture of the lighter with the heavier gases, much of the rich hydrocarbons are saved, which otherwise would be lost during the process of manufacture.

It is with the experience of over 30 years continuous observation to this essential branch of science that Mr. Romans ventures to place at the disposal of his friends, Corporations, and Gas Companies at home and abroad, the practical knowledge he has thus acquired in the basis of gas manufacture and its residual products. Also upon all matters appertaining to the mechanical department of Gas-Works, he is, as a bred engineer, prepared to advise or contract for the supply or repair of the apparatus, or overlook and attest its construction for exportation.

OFFICES:
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N.B.—Mr. Romans has no INTEREST in, nor is he AGENT for, any special Colliery.

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BRETTELL'S ESTATE

FIRE CLAY & BRICK WORKS,

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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.

Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.

Successors to
E. BAKER AND CO., LATE BRIERLEY HILL, STAFFORDSHIRE.

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Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAY.
Manufacturers for Home and Export.
GAS-RETORTS, GLASS-HOUSE FURNACE,
BLAST-FURNACE, TANK BRICKS, LUMPS, TILES,
And Every Description of Best Fire-Bricks.

B. CARPENTER,

(ESTABLISHED MORE THAN 15 YEARS,)

THE ORIGINAL MANUFACTURER OF

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FOR

GAS PURIFIERS & SCRUBBERS.

WORKS:
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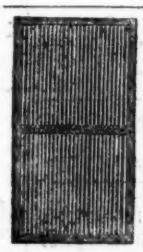
LONDON, N.



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RENOWNED

WOOD SIEVES,

WITH TAPER BARS,

MADE BY MACHINERY

CAPABLE OF MAKING 10,000 FEET WEEKLY.

References to Hundreds of First-Class Engineers.

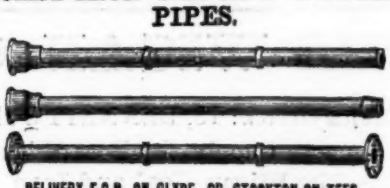
ROSE MOUNT IRON-WORKS
ELLAND, NEAR HALIFAX.

GAS AND WATER PIPES.

WILLIAM MACLEOD & CO.,

18 & 20, ALSTON STREET, GLASGOW.

CAST-IRON GAS AND WATER PIPES.



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Prices on application.

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CANNEL COAL MERCHANT,

173, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

CANNEL COAL.

COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their

CANNEL FOR GAS-MAKING PURPOSES.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to The Coppa Colliery, Mold, FLINTSHIRE.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Keep in London and at their works large stocks of PIPES and CONNEXIONS (1½ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

CHARLES HORSLEY, Agent.

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NEAR NEWCASTLE-UPON-TYNE,

Manufacturer of

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MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c., &c.,

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"SELLARS' CEMENT"

PREVENTS WASTE OF GAS FROM RETORTS;

SAVES CLAY RETORTS FROM DESTRUCTION BY FIRE;

GREATLY ECONOMIZES THE USE OF FIRE-BRICKS;

And PREVENTS ALL POSSIBLE LOSS of GAS FROM LEAKAGE.

J. C. SELLARS,

THE GAS CEMENT WORKS,

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CATOPTRIC LAMPS.

The NEW PATTERN Is now placed throughout CHEAPSIDE.

For Terms of Licence to Use and Manufacture, apply to

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STRAND.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

HEBBURN MAIN GAS COALS.

Cubic feet of Gas yielded per ton . . .	10,050
Illuminating power in sperm candles . .	15·4
Yield of coke per ton of good quality . .	13¾ cwts.

THE TYNE COAL COMPANY, LIMITED, OWNERS.

W. RICHARDSON, Fitter,

29, QUAYSIDE, NEWCASTLE-ON-TYNE.

PLUTONIC CEMENT,

For Repairing Gas-Retorts in Action, preventing Porosity, and reducing the Deposit of Carbon, is highly commended.

WILLIAM RICHARDSON,

GAS AND HYDRAULIC ENGINEER,

CHARLES HENRY STREET AND BISSELL STREET, BIRMINGHAM.

BIRTLEY IRON WORKS,

CHESTER-LE-STREET, DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Agent in London, Mr. J. MANWARING, 101 Cannon Street, E.C.

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Inventor of the

DRY-FACED CENTRE-VALVE FOR PURIFIERS,

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SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

CANNEL COAL MERCHANT,

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Established 1840.

THE

FRAMWELLGATE COAL COMPANY,

DURHAM,

Are prepared to supply their

SCREENED AND NUT GAS COALS.

This Coal yields 11,000 cubic feet of gas and 13½ cwts. of coke per ton.

OFFICES: ROYAL EXCHANGE, MIDDLESBROUGH.

W. GARDNER AND CO.,

STEAM SAW MILLS,

13 WHARF, MACCLESFIELD STREET NORTH, CITY ROAD,

Makers of

WOOD SIEVES FOR GAS PURIFIERS,

ROUND OR SQUARE, PARALLEL OR BEVELLED.

CHEAPEST IN LONDON.

C. & W. WALKER'S

WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

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DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

8, FINSBURY CIRCUS, LONDON.

J. T. B. PORTER & CO.,

GAS ENGINEERS & MANUFACTURERS,

IRONFOUNDERS AND CONTRACTORS,

GOWTS BRIDGE WORKS,

LINCOLN.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—It is most particularly requested that all Communications be addressed to the FIRM ONLY, as circumstances have arisen which render this necessary.

G. J. EVESON,

GAS COAL MERCHANT,

STOURBRIDGE.

Delivery per Rail to any Part.

THE WIGAN COAL & IRON COMPANY,

LIMITED,

DISTRICT OFFICE: 18, BENNETT'S HILL, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN;

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

ALBERT GAS COAL.

THE DERBYSHIRE

SILKSTONE COAL COMPANY,

LIMITED,

CAN OFFER A

GAS COAL

Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	10,775
Weight of coke in lbs. per ton of coal	1,465

ANALYSIS AND PRICES ON APPLICATION TO

Mr. EDMUND TAYLOR, Secretary,

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MESSRS. NEWTON, CHAMBERS, & CO.,

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NEAR SHEFFIELD,

STRONGLY RECOMMEND A TRIAL OF THEIR

CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.

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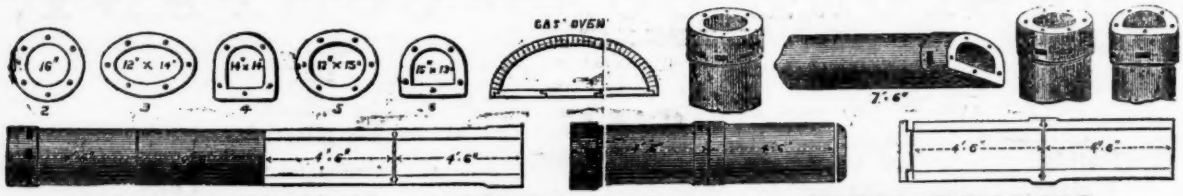

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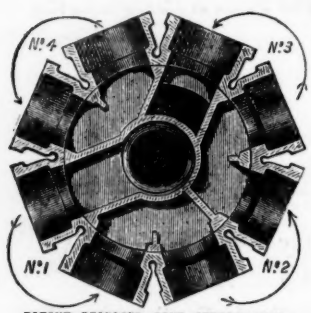

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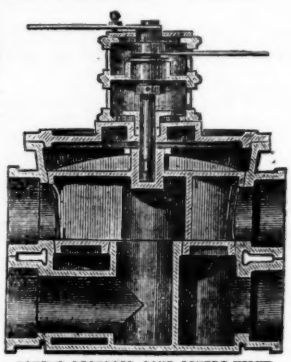

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